

Unclassified

ENV/JM/MONO(2011)54

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

16-Dec-2011

English - Or. English

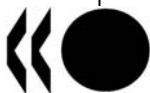
ENVIRONMENT DIRECTORATE
JOINT MEETING OF THE CHEMICALS COMMITTEE AND
THE WORKING PARTY ON CHEMICALS, PESTICIDES AND BIOTECHNOLOGY

NATIONAL ACTIVITIES ON LIFE CYCLE ASSESSMENT OF NANOMATERIALS

Series on the Safety of Manufactured Nanomaterials
No. 32

JT03313510

Document complet disponible sur OLIS dans son format d'origine
Complete document available on OLIS in its original format



ENV/JM/MONO(2011)54
Unclassified

English - Or. English

OECD Environment, Health and Safety Publications

Series on the Safety of Manufactured Nanomaterials

No. 32

**NATIONAL ACTIVITIES ON LIFE CYCLE ASSESSMENT OF
NANOMATERIALS**

IOMC

INTER-ORGANIZATION PROGRAMME FOR THE SOUND MANAGEMENT OF CHEMICALS

A cooperative agreement among **FAO, ILO, UNEP, UNIDO, UNITAR, WHO, World Bank and OECD**

Environment Directorate
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
Paris, 2011

Also published in the Series of Safety of Manufactured Nanomaterials:

- No. 1, *Report of the OECD Workshop on the Safety of Manufactured Nanomaterials: Building Co-operation, Co-ordination and Communication (2006)*
- No. 2, *Current Developments/ Activities on the Safety of Manufactured Nanomaterials: Tour de table at the 1st Meeting of the Working Party on Manufactured Nanomaterials (2006)*
- No. 3, *Current Developments/ Activities on the Safety of Manufactured Nanomaterials: Tour de table at the 2nd Meeting of the Working Party on Manufactured Nanomaterials (2007)*
- No. 4, *Manufactured Nanomaterials: Programme of Work 2006-2008 (2008)*
- No. 5, *Current Developments/ Activities on the Safety of Manufactured Nanomaterials: Tour de table at the 3rd Meeting of the Working Party on Manufactured Nanomaterials (2008)*
- No. 6, *List of Manufactured Nanomaterials and List of Endpoints for Phase One of the OECD Testing Programme (2008)*
- No. 7, *Current Developments/ Activities on the Safety of Manufactured Nanomaterials: Tour de table at the 4th Meeting of the Working Party on Manufactured Nanomaterials (2008)*
- No. 8, *Preliminary Analysis of Exposure Measurement and Exposure Mitigation in Occupational Settings: Manufactured Nanomaterials (2009)*
- No. 9, *EHS Research Strategies on Manufactured Nanomaterials: Compilation of Outputs (2009)*
- No. 10, *Identification, Compilation and Analysis of Guidance Information for Exposure Measurement and Exposure Mitigation: Manufactured Nanomaterials (2009)*
- No. 11, *Emission Assessment for the Identification of Sources and Release of Airborne Manufactured Nanomaterials in the Workplace: Compilation of Existing Guidance (2009)*
- No. 12, *Comparison of Guidance on Selection of Skin Protective Equipment and Respirators for Use in the Workplace: Manufactured Nanomaterials (2009)*
- No. 13, *Report of an OECD Workshop on Exposure Assessment and Exposure Mitigation: Manufactured Nanomaterials (2009)*
- No. 14, *Guidance Manual for the Testing of Manufactured Nanomaterials: OECD Sponsorship Programme (2009)*
- No. 15, *Preliminary Review of OECD Test Guidelines for their Applicability to Manufactured Nanomaterials (2009)*

- No. 16, *Manufactured Nanomaterials: Work Programme 2009-2012 (2009)*
- No. 17, *Current Development/ Activities on the Safety of Manufactured Nanomaterials: Tour de table at the 5th Meeting of the Working Party on Manufactured Nanomaterials (2009)*
- No. 18, *Manufactured Nanomaterials: Roadmap for Activities during 2009 and 2010 (2009)*
- No. 19, *Analysis of Information Gathering Initiative on Manufactured Nanomaterials (2009)*
- No. 20, *Current Development/ Activities on the Safety of Manufactured Nanomaterials: Tour de table at the 6th Meeting of the Working Party on Manufactured Nanomaterials (2010)*
- No. 21, *Report of the Workshop on Risk Assessment of Manufactured Nanomaterials in a Regulatory Context (2010)*
- No. 22, *OECD Programme on the Safety of Manufactured Nanomaterials 2009-2012: Operational Plans of the Projects (2010)*
- No. 23, *Report of the Questionnaire on Regulatory Regimes for Manufactured Nanomaterials (2010)*
- No. 24, *Preliminary Guidance Notes on Sample Preparation and Dosimetry for the Safety Testing of Manufactured Nanomaterials (2010)*
- No. 25, *Guidance Manual for the Testing of Manufactured Nanomaterials: OECD Sponsorship Programme: First Revision (2010)*
- No. 26, *Current Development/ Activities on the Safety of Manufactured Nanomaterials: Tour de table at the 7th Meeting of the Working Party on Manufactured Nanomaterials (2010)*
- No. 27, *List of Manufactured Nanomaterials and List of Endpoints for Phase One of the Sponsorship Programme for the Testing Manufactured Nanomaterials: Revised (2010)*
- No. 28, *Compilation and Comparison of Guidelines Related to Exposure to Nanomaterials in Laboratories (2010)*
- No. 29, *Current Development/ Activities on the Safety of Manufactured Nanomaterials: Tour de table at the 8th Meeting of the Working Party on Manufactured Nanomaterials (2011)*
- No. 30, *Regulated Nanomaterials: 2006-2009 (2011)*
- No. 31, *Information Gathering Schemes on Nanomaterials: Lessons Learned and Reported Information (2011)*

© OECD 2011

Applications for permission to reproduce or translate all or part of this material should be made to: RIGHTS@oecd.org, Head of Publications Service, OECD, 2 rue André-Pascal, 75775 Paris Cedex 16, France

ABOUT THE OECD

The Organisation for Economic Co-operation and Development (OECD) is an intergovernmental organisation in which representatives of 34 industrialised countries in North and South America, Europe and the Asia and Pacific region, as well as the European Commission, meet to co-ordinate and harmonise policies, discuss issues of mutual concern, and work together to respond to international problems. Most of the OECD's work is carried out by more than 200 specialised committees and working groups composed of member country delegates. Observers from several countries with special status at the OECD, and from interested international organisations, attend many of the OECD's workshops and other meetings. Committees and working groups are served by the OECD Secretariat, located in Paris, France, which is organised into directorates and divisions.

The Environment, Health and Safety Division publishes free-of-charge documents in ten different series: **Testing and Assessment; Good Laboratory Practice and Compliance Monitoring; Pesticides and Biocides; Risk Management; Harmonisation of Regulatory Oversight in Biotechnology; Safety of Novel Foods and Feeds; Chemical Accidents; Pollutant Release and Transfer Registers; Emission Scenario Documents; and Safety of Manufactured Nanomaterials.** More information about the Environment, Health and Safety Programme and EHS publications is available on the OECD's World Wide Web site (www.oecd.org/ehs/).

This publication was developed in the IOMC context. The contents do not necessarily reflect the views or stated policies of individual IOMC Participating Organizations.

The Inter-Organisation Programme for the Sound Management of Chemicals (IOMC) was established in 1995 following recommendations made by the 1992 UN Conference on Environment and Development to strengthen co-operation and increase international co-ordination in the field of chemical safety. The Participating Organisations are FAO, ILO, UNEP, UNIDO, UNITAR, WHO, World Bank and OECD. UNDP is an observer. The purpose of the IOMC is to promote co-ordination of the policies and activities pursued by the Participating Organisations, jointly or separately, to achieve the sound management of chemicals in relation to human health and the environment.

This publication is available electronically, at no charge.

**For this and many other Environment,
Health and Safety publications, consult the OECD's
World Wide Web site (www.oecd.org/ehs/)**

or contact:

**OECD Environment Directorate,
Environment, Health and Safety Division
2 rue André-Pascal
75775 Paris Cedex 16
France**

Fax: (33-1) 44 30 61 80

E-mail: ehscont@oecd.org

FOREWORD

The OECD Joint Meeting of the Chemicals Committee and Working Party on Chemicals, Pesticides and Biotechnology (the Joint Meeting) held a Special Session on the Potential Implications of Manufactured Nanomaterials for Human Health and Environmental Safety (June 2005). This was the first opportunity for OECD member countries, together with observers and invited experts, to begin to identify human health and environmental safety related aspects of manufactured nanomaterials. The scope of this session was intended to address the chemicals sector.

As a follow-up, the Joint Meeting decided to hold a Workshop on the Safety of Manufactured Nanomaterials in December 2005, in Washington, D.C. The main objective was to determine the “state of the art” for the safety assessment of manufactured nanomaterials with a particular focus on identifying future needs for risk assessment within a regulatory context.

Based on the conclusions and recommendations of the Workshop [ENV/JM/MONO(2006)19] it was recognised as essential to ensure the efficient assessment of manufactured nanomaterials so as to avoid adverse effects from the use of these materials in the short, medium and longer term. With this in mind, the OECD Council established the OECD Working Party on Manufactured Nanomaterials (WPMN) as a subsidiary body of the OECD Chemicals Committee in September 2006. The Working Party is responsible for the implementation of the OECD Programme on the Safety of Manufactured Nanomaterials. This programme concentrates on human health and environmental safety implications of manufactured nanomaterials (limited mainly to the chemicals sector), and aims to ensure that the approach to hazard, exposure and risk assessment is of a high, science-based, and internationally harmonised standard. It promotes international co-operation on the human health and environmental safety of manufactured nanomaterials, and involves the safety testing and risk assessment of manufactured nanomaterials.

This document is published under the responsibility of the Chemicals Committee of the OECD. This is intended to provide delegations and other stakeholders with a “snapshot” of information on activities related to the Life Cycle Assessment of Manufactured Nanomaterials at the national and international level.

This document facilitates the implementation of the OECD Programme on the Safety of Manufactured Nanomaterials by allowing delegations to share their experiences and preoccupations with respect to safety, and identifies opportunities for future co-operation and co-ordination.

TABLE OF CONTENTS

ABOUT THE OECD	6
FOREWORD	8
OECD'S PROGRAMME ON THE SAFETY OF MANUFACTURED NANOMATERIALS	11
SUMMARIES FROM DELEGATIONS	12
AUSTRIA	12
NANOFORCE "Nanotechnology for Chemical Enterprises – how to link scientific knowledge to the business in the Central Europe"	12
NanoRate: Matrix Representation of the Use and Risks of Nanoproducts	12
Sustainability assessment of nano-products	12
FINLAND	12
EffNet (Efficient Networking towards Novel Products and Processes, 2010 – 2013) programme.....	12
GERMANY	13
Study of nanoparticle emission of selected products during their life cycle	13
Guideline to investigate and compare benefit and risk aspects of nano products in their life cycle	13
KOREA.....	14
Guideline for the life cycle assessment (LCA) of nanomaterials.....	14
POLAND	14
Innovative polymer and carbon materials for respiratory protection against nanoparticles, vapours and gases	14
UNITED KINGDOM	15
NanoLifeCycle	15
Research programmes or strategies which focus on life cycle aspects of nanomaterials.....	15
Modelling environmental concentrations of nanosilver in the UK.....	15
A comparative methodology for estimating the economic value of innovation in nanotechnologies...	16
THE UNITED STATES	16
National Nanotechnology Initiative Signature Initiative: Sustainable Nanomanufacturing – Creating the Industries of the Future.....	16
National Nanotechnology Initiative Signature Initiative: Nanotechnology for Solar Energy Collection and Conversion	17
EPA Lithium-ion Battery Nano Life Cycle Assessment Partnership.....	17
EPA Partnership on Flame Retardant Alternatives to decaBDE Project.....	17
Nanotechnology for Waste and Cleanup.....	19
EPA Alternative Chemical Synthetic Pathways - Nanomaterials	19

EUROPEAN COMMISSION.....	20
NANOSUSTAIN: Development of sustainable solutions for nanotechnology-based products based on hazard characterization and LCA.....	20
PROSUITE: Development and application of standardized methodology for the PROspective SUstaInability assessment of Technologies.....	20
NANOPOLYTOX: Toxicological impact of nanomaterials derived from processing, weathering and recycling of polymer nanocomposites used in various industrial applications.....	21
NANOFATE: Nanoparticle Fate Assessment and Toxicity in the Environment.....	21
NANOHOUSE: Life Cycle of Nanoparticle-based Products used in House Coating.....	22
Nanex: Development of Exposure Scenarios for Manufactured Nanomaterials.....	22
LCA TO GO: Boosting Life Cycle Assessment Use in European Small and Medium-sized Enterprises: Serving Needs of Innovative Key Sectors with Smart Methods and Tools.....	23
ENFIRO: Life cycle assessment of environment-compatible flame retardants (Prototypical case study).....	23
ECOPHARMABUILDING: Eco-Innovation of Pharmaceutical Buildings Supporting in Sustainable LCA Tools.....	24
BUSINESS AND INDUSTRY ADVISORY COMMITTEE TO THE OECD	
(BIAC)- NANOTECHNOLOGY INDUSTRIES ASSOCIATION (NIA).....	24
Benefits of Nanotechnologies: Valuing Nanotechnologies- Methodology for estimating, in monetary terms, the benefits of nanotechnology.....	24
Commercialisation: Best Practices for IPR and Technology Transfer in Nanotechnology Developments.....	24
Market-Specific R&D: Transforming the future of heat management (NanoHex).....	25

OECD'S PROGRAMME ON THE SAFETY OF MANUFACTURED NANOMATERIALS

The OECD's Programme on the Safety of Manufactured Nanomaterials^[1] was established in 2006 to help member countries efficiently and effectively address the safety challenges of nanomaterials. OECD has a wealth of experience in developing methods for the safety testing and assessment of chemical products.

The Programme brings together more than 100 experts from governments and other stakeholders from: a) OECD Countries; b) non-member economies such as China, the Russian Federation, Singapore, South Africa, and Thailand; and c) observers and invited experts from UNITAR, FAO, WHO, ISO, BIAC^[2], TUAC^[3], and environmental NGOs.

Although OECD member countries appreciate the many potential benefits from the use of nanomaterials, they wished to engage, at an early stage, in addressing the possible safety implications at the same time as research on new applications are being undertaken.

The Programme of Work is being implemented through specific projects to further develop appropriate methods and strategies to help ensure human health and environmental safety:

- OECD Database on Manufactured Nanomaterials to Inform and Analyse EHS Research Activities;
- Safety Testing of a Representative Set of Manufactured Nanomaterials;
- Manufactured Nanomaterials and Test Guidelines;
- Co-operation on Voluntary Schemes and Regulatory Programmes;
- Co-operation on Risk Assessment;
- The role of Alternative Methods in Nanotoxicology;
- Exposure Measurement and Exposure Mitigation; and
- Environmentally Sustainable Use of Manufactured Nanomaterials

Each project is being managed by a steering group, which comprises members of the OECD Working Party on Manufactured Nanomaterials (WPMN), with support from the Secretariat. Each steering group implements its respective "operational plans", each with their specific objectives and timelines. The outputs of each project are then evaluated and endorsed by the WPMN, and subsequently by the OECD Chemicals Committee.

More information about the work of the OECD's Programme on the Safety of Manufactured Nanomaterials, as well as OECD's publications regarding safety issues of nanomaterials, is available at www.oecd.org/env/nanosafety.

^[1] Updated information on the OECD's Programme on the Safety of Manufactured Nanomaterials is available at: www.oecd.org/env/nanosafety

^[2] The Business and Industry Advisory Committee to the OECD

^[3] Trade Union Advisory Committee to OECD

SUMMARIES FROM DELEGATIONS

This document compiles information on national activities on life cycle assessment and nanotechnologies provided by delegations. The compilation includes information from: Austria, Finland, Germany, Korea, Poland, the United Kingdom, United States, the European Commission, as well as from the Business and Industry Advisory Committee to the OECD (BIAC).

This document is intended to provide a “snapshot” of information on activities related to the Life Cycle Assessment of Manufactured nanomaterials at the national and international level. As a living document, it is expected to be updated as new information becomes available.

AUSTRIA

NANOFORCE "Nanotechnology for Chemical Enterprises – how to link scientific knowledge to the business in the Central Europe"

BioNanoNet Forschungsgesellschaft mbH is partner in this project and responsible for the workpackage **"How to foster the responsible use of nanotech and manage associated risks"**. Aim of the project is to foster the innovative nanotechnology-sector networks across Central Europe regions by bringing together public and private organisations to carry out collaborative & interdisciplinary researches on nanomaterials (in the frame of REACH Regulation) and to turn the most promising laboratory results into innovative industrial applications, not only to produce new materials but also to improve the industrial sustainability (more security & lower environmental impact in the life cycle of products)

NanoRate: Matrix Representation of the Use and Risks of Nanoproducs

In the project **NanoRate** risks and benefits of nanoproducs were assessed. (For downloading the final report see <http://www.umweltnet.at/article/articleview/83094/1/7033>).

Sustainability assessment of nano-products

A scientific study regarding **"Sustainability assessment of nano-products"** was conducted in cooperation of the Environment Agency Austria and the University of Applied Sciences, Technikum Wien.

FINLAND

EffNet (Efficient Networking towards Novel Products and Processes, 2010 – 2013) programme

Forestcluster LTD (a public-partnership for science, technology and innovations) runs a EffNet (Efficient Networking towards Novel Products and Processes, 2010 – 2013) programme that focuses, on one hand, on developing radically new energy and resource efficient web production technologies and, on the other hand, reengineering the product concept of fiber based products with nanocellulose¹. The E15 million programme develops and demonstrates new types of products, but carries out also safety assessment of nanocellulose applications and studies their life-cycle.

GERMANY

Öko-Institut e.V. (Institute for Applied Ecology) is currently developing a general assessment system for evaluation of sustainability aspects of nanotechnological products. The work is part of a project supported by the UBA (Umweltbundesamt, Environmental Ministry). The assessment system is being tested in pilot projects and will serve as a basis for strategic optimization of products. BASF and Nanogate are participating in the pilot.

Study of nanoparticle emission of selected products during their life cycle

A reference study was commissioned by the Federal Environmental Agency (Umweltbundesamt) to summarise the current knowledge and research needs in the area of emission of nanoscale particles from products in the course of their life cycle as well as their possible environmental effects (relevance). For this purpose, information about nanoscale silver, titanium dioxide, carbon black, cerium oxide used in wipes, wall paint, in tires and additives in fuel, were compiled and evaluated.

Possible measurement techniques and methods, for different measurement parameters and matrices, for examining the emission and characterizing nanostructures and their behaviour in the environment were summarized in a separate section.

This study performed by the Institute for Energy and Environmental Technology (IUTA) e.V., Duisburg, Germany revealed that there is a serious lack of knowledge on the subject. Appropriate measuring methods by which nanoparticles in the environment can be detected and identified, for example, are still lacking. The final report is written in German, but includes an English summary (Web: <http://www.uba.de/uba-info-medien-e/4028.html>).

Guideline to investigate and compare benefit and risk aspects of nano products in their life cycle

The NanoKommission, a stakeholder commission on Nanotechnologies, established by the Federal Environment Ministry ("NanoDialogue 2009-2011")

The NanoKommission had the task of discussing the opportunities and risks of nanotechnologies and formulating recommendations to the Federal Government regarding the responsible use of these technologies. The four expert working groups of Germany's NanoKommission (2009-2011) dealing with the implementation of the principles, benefit and risk potentials, regulatory aspects of nanomaterials and further development of criteria on concerns and reliefs presented their final reports on the "Dialogforum" on February 2nd in Berlin. The related documentation (only in German, an English version is in preparation) is available under the Web: <http://www.bmu.de/chemikalien/nanotechnologie/nanodialog/doc/46552.php>.

One of the four thematic groups has developed life cycle considerations on potential positive and negative impacts of nano-enabled application throughout the lifecycle. The group developed a guideline consisting of a fact sheet of the product and a check list of criteria. The aim is to support transparency of the dialogue, to structure the ascertainment and illustration of the information and results and to sensitise enterprisers and developers for benefit and risk aspects of their products.

KOREA

Guideline for the life cycle assessment (LCA) of nanomaterials

The Korean Ministry of the Environment (MOE) developed a document on the “Guideline for the life cycle assessment (LCA) of nanomaterials.”

POLAND

Innovative polymer and carbon materials for respiratory protection against nanoparticles, vapours and gases

The Central Institute for Labour Protection has been realising the project no OPIE 01.01.02-10-018/09-01 “Innovative polymer and carbon materials for respiratory protection against nanoparticles, vapours and gases.” (Period: 01.05.2009 r. - 30.06.2013)

The project is implemented under the Operational Programme Innovative Economy OPIE, 2007-2013 Priority 1: "Research and development of new technologies" Measure 1.1: "Support for scientific research for the economy knowledge-based" Action 1.1.2: "The strategic research programs and work development"

Project leader is Central Institute for Labor Protection - National Research Institute CIOP-PIB Project and the partner is Technical University of Lodz. Faculty of Process and Environmental.

The main goal is to improve the safety and comfort of workers exposed to aggressive work environment using personal protective equipment.

The indirect purpose - the development of innovative nonwoven materials based on polymers that are part of the design of filtering respiratory protective equipment in order to implement effective protection against nanoparticles of air pollutants and modified carbon materials with the properties to clean the air of specific vapours and gases.

Additional information:

- Despite small expenditures on science and laboratory tests there is carried out research in nanotechnology in general. There are three main centers of research on nanotechnology (in total 25 centers): Institutions operating at the Academy of Sciences, Warsaw University of Technology and Wrocław University of Technology. The centers which are less concerned with these issues are: Poznan University of Technology and Silesian University of Technology. In these centers studies on the following issues are conducted: supporting information technology, bioengineering (biotechnology), new systems (nanosystems), new energy sources (eg, using carbon nanotubes), and new materials (such as. "smart materials").
- In Poland 3 large nanotechnology centers have been started: in Lodz, Szczecin and Gdansk. In the framework of investment in Lodz, called “BioNanoPark”, there is planned to be built a new Laboratory of Molecular and Nanostructural Biophysics that will have started its activity by the end of 2013. Laboratory of Molecular and Nanostructural Biophysics will deal with influence of products of nanotechnology on human’s health and environment. It will also elaborate new generic medicines and therapeutic remedies.

- Two big national conferences on nanotechnology were held in Poland in 2010: 4th National Conference on Nanotechnology NANO 2010 and NANOTECHNOLOGIA-PL, 14.09.2010, Warsaw. The Nofer Institute of Occupational Medicine NIOM is the leading institute in the field of occupational and environmental health in Poland having the status of WHO Collaborating Centre. Scientists from NIOM participated in several EU funded projects on nanosafety issues for example NANOGENOTOX and recently - MARINA (Reference methods for managing the risks of engineered nanoparticles) project.

UNITED KINGDOM

NanoLifeCycle

A lifecycle assessment study of the route and extent of human exposure via inhalation for commercially available products and applications containing carbon nanotubes (CNTs) completed in 2009, which was led by the Food and Environment Research Agency (FERA) with participation of other UK/EU academic and industrial Experts. The study identified different available CNT-containing products on the market, and assessed the possibility of inhalation exposure to CNTs during different stages of the life cycle of lithium-ion batteries, epoxy adhesive resin and textiles. The study also assessed the current ISO protocols for lifecycle assessment (LCA) for their relevance and adequacy to the assessment of inhalation exposure to CNT and other nano-products.

(Web: <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16388&FromSearch=Y&Publisher=1&SearchText=CB0423&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description>).

Research programmes or strategies which focus on life cycle aspects of nanomaterials

The Natural Environment Research Council, in cooperation with the Engineering & Physical Sciences Research Council, the Department for Environment, Food & Rural Affairs, the Environment Agency and the United States Environmental Protection Agency, has funded three research consortia through a major joint UK-US initiative. A total of \$12M will be invested across these projects which will investigate both terrestrial and aquatic ecosystems and cover a wide range of disciplines including material science, detection and characterisation, biological interactions (ecotoxicology), modelling, risk analysis and novel technology development.

Modelling environmental concentrations of nanosilver in the UK

In view of the use of nanosilver as an antimicrobial agent in a growing array of consumer products, and mindful of widespread interest and concerns in some quarters regarding possible environmental impacts, the UK Department for Environment, Food and Rural Affairs (Defra) has commissioned a monitoring and modelling study to ascertain likely environmental exposure to nanosilver in the UK aquatic environment. This study will undertake monitoring to measure concentrations at 6 'typical' UK sewage treatment plants (STP). The results will then be used to map current and foreseen UK environmental exposure, using a Geographical Information System (GIS)-based model of UK waterways, effluent sources and water treatment facilities. This work will provide a geographical record of silver concentrations. It will also provide an analysis of that partition of silver which ends up in sludge at water treatment works, enabling an estimate to be made of amounts of silver in sludge which end up in soils and other environmental compartments.

A comparative methodology for estimating the economic value of innovation in nanotechnologies

While a great deal has been invested around the world on nano innovation, no robust methodology has existed until now to estimate the value of the potential benefits. The UK Department for Environment, Food & Rural Affairs (Defra) has recently published a methodology for estimating, in monetary terms, the benefits of nanotechnology. This ground-breaking toolkit will enable calculations to be made to estimate the monetary value of nanotechnology products and applications.

The toolkit has been funded by Defra and developed by the UK research consultancy Oakdene Hollins Ltd. It provides a methodology that enables users to value nanotechnology applications, by comparing them to alternative, incumbent technologies. It enables the economic benefits accruing to producers and consumers to be considered, as well as wider benefits to the economy, environment and society. The added value of a nano-application can be calculated over a specified timeframe and can be related to a particular geographical region. If human health or environment risk data is available, this can also be factored in to the calculation.

The project deliverables have been designed for use by (1) policy makers and governments, to perform costs benefit analysis; (2) industry, to estimate the social benefits of a product i.e. to compare against any potential risks; and (3) funders, to impartially appraise the relative benefits of proposals when reaching funding decisions.

THE UNITED STATES

US EPA released in October 2010 a document titled *Nanomaterial Case Studies: Nanoscale Titanium Dioxide in Water Treatment and in Topical Sunscreen*. The case studies incorporate a comprehensive environmental assessment (CEA) framework, which combines a product life-cycle perspective with the risk assessment paradigm. This document will be used as part of a process to identify and prioritise research needs in developing data to inform nanomaterials risk assessment. Environmental Protection Agency (EPA)'s draft case study, *Nanoscale Silver in Spray Applications*, is available for external review at: <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=226723>.

National Nanotechnology Initiative Signature Initiative: Sustainable Nanomanufacturing – Creating the Industries of the Future

The decade of investment in the NNI can become the basis for high-value industries only if suitable manufacturing technology is available. Current methods, such as those used in the semiconductor industry, are not scalable or economical for the diversity of materials at the volumes and length scales required: radically new approaches are needed. Moreover, for such products to be ubiquitous in the nation's future economy, they, and their associated manufacturing processes, must be environmentally sustainable by design. To create the foundation for achieving this vision, the goal of this initiative is to accelerate the development of industrial-scale, inherently safe and green methods for manufacturing of functional nanoscale systems. The initiative targets three classes of sustainable materials (high-performance, structural carbon-based nanomaterials, optical metamaterials, and cellulosic nanomaterials) that have the potential to affect multiple industry sectors with significant economic impact. An essential prerequisite to the development of cost-effective and green nanomanufacturing is the availability of high-throughput, in-line metrology to enable closed-loop process control and quality assurance. The initiative is therefore focused directly on the development of inexpensive, fast and accurate measurement techniques. The U.S. still has expertise in the area of roll-to-roll manufacturing, which is applicable to the types of high-volume fabrication processes envisioned. The initiative is thus explicitly directed to the formation of an

industry/government/academic consortium devoted to the development of metrology methods to enable roll-to-roll to be applied to nanomanufacturing. The formation of consortia is also a key aspect of the specific material thrusts. The systems to be manufactured, based on these methods, will include disruptive technologies for light-weight, high-strength sustainable materials, solar energy harvesting, waste heat management and recovery, and energy storage. If the initiative is successful, the methods developed will be immediately extensible to more complex components and systems as future nanodevices mature and will help secure and strengthen the U.S. manufacturing base.

(Web: <http://nano.gov/html/research/NNISigInitSustainableMfrFINALJuly2010.pdf>).

National Nanotechnology Initiative Signature Initiative: Nanotechnology for Solar Energy Collection and Conversion

(Web: <http://nano.gov/html/research/NNISigInitSolarEnergyFinalJuly2010.pdf>).

EPA Lithium-ion Battery Nano Life Cycle Assessment Partnership

The partnership is conducting a screening-level life-cycle assessment (LCA) of currently manufactured lithium-ion (Li-ion) battery technologies and a next generation battery component (anode) that uses single-wall carbon nanotube (SWCNT) technology. Established in June 2009, the partnership is being led by EPA's Design for the Environment (DfE) Program and its Office of Research and Development (ORD).

A quantitative environmental life-cycle analysis of Li-ion batteries used in electric drive vehicles—and the nanomaterials and nanotechnology used to produce some of them—has not been conducted, and is needed to help grow the advanced-vehicle battery industry in an environmentally responsible and efficient way.

This partnership project offers the opportunity to mitigate current and future impacts and risks by helping battery manufacturers and suppliers identify materials and/or processes associated with the greatest environmental impacts throughout the life cycle of their products, and identify areas that could benefit from increased energy efficiency. The project is timely because using Li-ion batteries in electric vehicles is an emerging technology, and recent government programs are encouraging the growth of the Li-ion battery industry in the United States (Web: <http://www.epa.gov/dfeprojects/lbnp/index.htm>).

EPA Partnership on Flame Retardant Alternatives to decaBDE Project

Manufactured Nanomaterials covered in this project are Nanoclays, Silica and Carbon nanotubes.

Decabromodiphenyl ether (decaBDE) is a flame retardant used widely in a number of materials to meet flammability standards. Most commonly, decaBDE is added to high-impact polystyrene (HIPS) for casings of electronic equipment such as televisions. DecaBDE is also used as a flame retardant in wire and cable jacketing and in textile backcoatings for furniture, draperies, and carpets. DecaBDE is incorporated in many other products, including adhesives, motor vehicles parts, computers, and major appliances.

EPA is concerned that certain polybrominated diphenyl ethers (PBDEs), are persistent, bioaccumulative, and toxic to both humans and the environment. This concern extends to decaBDE, which breaks down into other PBDE congeners. Various PBDEs have been studied for ecotoxicity in mammals, birds, fish, and invertebrates. In some cases, current levels of PBDE exposure for wildlife may be at or near adverse effect levels. Human exposure to decaBDE can occur via diet, at the workplace, and at home. In December 2009, the largest commercial producers and suppliers of decaBDE in the United States agreed to phase out use of the chemical by 2012.

Its goal is to identify viable alternatives for decaBDE, evaluate their human health and environmental profiles, and inform decision making as organizations choose safer alternatives to decaBDE.

To address viable alternatives to decaBDE for two major functional uses: plastic electronics housings; and textile backcoatings, for which the majority of decaBDE is used. The assessment may also address inherently flame-retardant materials and innovative technologies.

Detailed projects are as follows:

- Conduct a comparative thermodynamic assessment of a nanocomponent using a conventional technology and establish a Life Cycle Inventory module;
- Development and application of Life Cycle Assessment framework for nanomaterials;
- Provide a holistic level Life Cycle Assessment for a Metal-based/CNT nanocomponent **Manufactured Nanomaterial**: Carbon nanotubes;
- Development of a Life Cycle Impact Assessment Methodology Suitable for Nanotechnology Applications;
- Environmental Fate and Transport of Nano-Scale Particles and their Influence on Mobility of Persistent Contaminants; **Manufactured Nanomaterial**: Titanium oxide;
- Develop a screening-level life cycle assessment case study for manufacturing of a metal based nanocomponent; **Manufactured Nanomaterial**: Silver;
- Develop synthesis strategies for eco-friendly synthesis of nanomaterials, including metals, metal-oxides, and nanocomposites; **Manufactured Nanomaterials**: Iron, Silver, Nickel, and Titanium oxide; and
- Develop and demonstrate nanoparticle synthesis using a continuous, process intensified reactor for higher efficiency; **Manufactured Nanomaterial**: Iron and Nickel.

EPA's Nanotechnology Research Program in the Office of Research and Development is conducting a series of Life Cycle Assessments (LCAs) on various products made from nanomaterials to gain knowledge about potential release into the environment. The assessments are holistic and comprehensive and track a product from its inception (cradle) through its final disposal (grave). LCAs are essential to analyze, evaluate, understand, and manage the overall health and environmental impacts of products.

LCA experts worldwide agree that existing LCA tools are capable of supporting the development of decisions on the manufacture and use of nanomaterials as long as uncertainties and data gaps are clearly stated (Kloepffer et al 2007).

In addition to tracking products made with nanomaterials throughout their life cycle to identify where and in which situations release may occur, scientists will identify and model impacts to environmental problems mentioned above as well as investigate safety issues of workers in the nanomanufacturing field (Meyer et al 2009) as part of the LCA.

Scientists will conduct an analysis using a life-cycle approach that will compare environmental impacts of current technology with nanotechnology used to make commonly known products.

The LCAs are focused on answering questions which include:

What are the trade-offs associated with nanomaterials?; and

Is the large-scale production of an environmentally taxing material justified if it has beneficial applications for society or if it can reduce costs or enhance performance?

Characterization of nanomaterials on a life cycle basis is challenging because this is a new field of study. Finding adequate data to model the potential fate and effects of unintended releases of nanomaterials into the environment may be difficult to obtain. EPA researchers are working to locate and provide the necessary data. Also, many nanomaterials are not yet in full production to create a consumer product, so much of the data must be estimated.

Products being studied include lithium batteries, which incorporate nanomaterials to enhance performance, and products that contain nano silver and titanium dioxide (such as sunscreen).

(Web: <http://www.epa.gov/nanoscience/quickfinder/lifecycle.htm>)

Nanotechnology for Waste and Cleanup

Nanoscale materials have potential beneficial applications for future environmental remediation or as detectors. For example, nanosized cerium oxide has been developed to decrease diesel emissions, and iron nanoparticles can remove contaminants from soil and ground water. Nanosized sensors hold promise for improved detection and tracking of contaminants in the environment.

In these and other ways, nanotechnology presents an opportunity to improve how we measure, monitor, manage, and reduce contaminants in the environment. EPA is interested in the potential benefits of nanotechnology and charged with regulating its disposal. A challenge for environmental protection is to help fully realize the societal benefits nanotechnology while identifying and minimizing any adverse impacts to humans or ecosystems from exposure to nanoscale materials.

EPA is working to gain a better understanding of how to best apply nanotechnology for pollution prevention in current manufacturing processes and in the manufacture of new nanoscale materials, as well as in environmental detection, monitoring, and clean-up of waste sites. This understanding will come from scientific information gathered by environmental research and development activities conducted by government agencies, academia, and the private sector.

(Web: <http://www.epa.gov/oswer/nanotechnology/index.htm>).

EPA Alternative Chemical Synthetic Pathways - Nanomaterials

Manufactured Nanomaterials in this project are Iron; Nickel; Palladium; Silver; and Titanium dioxide.

The heavy investment in the development and deployment of products containing nanomaterials is now a worldwide phenomenon. The unique physical and chemical properties of nanomaterials, such as different conductivity, optical sensitivity, and reactivity, originate mainly from factors such as small size, surface structure, chemical composition, shape, solubility, or aggregation. These varied properties are attractive for application in a variety of technology areas. Consequently, nanomaterials are becoming widely used in varied applications from cosmetics to semiconductors. Nanotechnology development and production presents a unique opportunity to offer a more sustainable approach to protect public health and the environment and prevent future environmental liability. There is a great need for EPA to provide manufacturers and users with the most up-to-date science on the potential risk of these materials on human health and the environment and robust information on how to prevent future environmental liability.

Our Approach is to develop a scientifically based framework for greener preparation of these materials in a manner that renders the materials less mobile in the environment and reduces or eliminates the use and

generation of hazardous substances, such as the hydrazine and borohydride reducing agents normally used in nanomaterials production. Three areas of opportunity are being exploited to engage green chemistry: (i) choice of solvent, (ii) the reducing agent employed, and (iii) the capping agent (or dispersing agent). The synthesis of nanometal/nanometal oxide/nanostructured polymers and their stabilization (through dispersant, biodegradable polymer) will involve the use of natural renewable resources such as plant material extract, biodegradable polymers, and sugars, and finally microwave (MW) irradiation as an efficient and selective mode of activation.

The long-term goal is to produce a “guide” for nanomaterial manufacturers to follow to limit risk to human health and the environment and prevent future clean-up of these materials if they are found to be toxic. In the short term, current research will also be extended to the use of other benign materials to synthesize nanometals/polymer nanostructures/nanopolymer composites and study their catalytic properties for various chemical and environmental remediation applications

(Web: <http://www.epa.gov/nrmrl/std/cppb/greenchem/greenchemaltsys.htm>).

EUROPEAN COMMISSION

A “Compendium of Projects in the European NanoSafety Cluster” was published in March 2010 and an update is expected during spring in February 2011 (<http://www.nanosafetycluster.eu/home/european-nanosafety-cluster-compendium.html>). Below is an extraction of projects of relevance for SG9 work. In addition, some other projects are ongoing, (e.g. Prosuite). (Web: http://cordis.europa.eu/pub/nanotechnology/docs/compendium-nanosafety-cluster2010_en.pdf; www.nanosafetycluster.eu).

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

EU Research Framework Programme 7. Start date: 2010-05-01, End date: 2013-04-30

The objective is to develop innovative solutions for the sustainable design, use, recycling and final treatment of nanotechnology-based products. This will be achieved by a comprehensive data gathering and generation of relevant missing data, as well as their evaluation and validation, for specific nano-products or product groups in relation to their human health and environmental hazards and possible impacts that may occur during after-production stages. NanoSustain will address the questions; how and to what degree society and the environment will be exposed to nano-materials and associated products; and where do these particles end up. Based on results from hazard characterization, impact assessment and LCA, the project will explore on a lab-scale new solutions for the design of selected nano-materials and associated products and their sustainable use, recycling and final treatment. NanoSustain will set the ground for the development of new sustainable products and industrial applications, and hence help to strengthen competitiveness of the European nanotechnology industry

(Web: http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_FR&ACTION=D&DOC=1&CAT=PROJ&QUERY=01282168dd1d:9f69:410e5aca&RCN=94362).

PROSUITE: Development and application of standardized methodology for the PROspective SUstainability assessment of Technologies.

EU Research Framework Programme 7. Start date: 2009-11-01, End date: 2013-10-31.

The main goal is to develop a framework methodology, operational methods and tools for the sustainability assessment of current and future technologies over their life cycle, applicable to different stages of maturity.

The project will apply the methodology for four technology cases with close consultation of the stakeholders involved, which includes cases from biorefineries, nanotechnology, information technologies, and carbon storage and sequestration. PROSUITE will show; 1) how to combine technology forecasting methods with life cycle approaches; and 2) how to develop and possibly combine the economic, environmental and social sustainability dimensions in a standardized, comprehensive and broadly accepted way. PROSUITE will create a solid research basis for technology characterization, including the identification of decisive technology features, basic engineering modules for estimations of material flows and energy use, and learning curves

(Web: http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&QUERY=0129036c7fbf.65d7:5981dbc2&RCN=92592).

NANOPOLYTOX: Toxicological impact of nanomaterials derived from processing, weathering and recycling of polymer nanocomposites used in various industrial applications.

EU Research Framework Programme 7. Start date: 2010-05-01, End date: 2013-04-30.

This project will evaluate the toxicological impact of nanomaterials included in polymer nanocomposites, highly used in various industrial sectors, during their life cycle. Raw nanomaterials and extracted nanomaterials will be characterized at different stages of their life cycle and their toxicity profiles will be obtained via in vitro and in vivo toxicity studies. The results from the in vivo studies will be used for the evaluation of the biological and environmental fate of nanomaterials. All the data generated during the project (physical, chemical and toxicological data) will be considered for the development of the novel LCIA methodology to apply to nanomaterials.

These studies will also be taken into account for the selection of adequate digestion and extraction methods to separate the nanomaterials from the polymeric matrices. Moreover, optimization of these methods will facilitate the development of recycling techniques that will be applied in the end-stage of polymer nanocomposites. The chemical recycling technique will be based on a new separation method consisting of nanofiber filters to separate efficiently the raw nanomaterials from the polymeric matrices and reuse them in new applications

(Web: http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_LANG=EN&PJ_RCN=11298812&pid=0&q=4C6B99B07A250605CB870D46BC247E2C&type=sim).

NANOFATE: Nanoparticle Fate Assessment and Toxicity in the Environment.

EU Research Framework Programme 7. EU Research Framework Programme 7. Start date: 2010-04-01, End date: 2014-03-31.

The objective is to fill knowledge and methodological gaps currently impeding sound assessment of environmental fate and risks posed by engineered nano-particles (ENPs) from high-volume products for which recycling is not an option; namely; fuel additive, personal care and antibacterial products. Two market ENPs from each product (CeO₂, ZnO, Ag of varying size, surface and core chemistries) will be followed through their post-production life cycles i.e. from environmental entry as spent product, through waste treatment to their final fates and potential toxic effects. This will test the applicability of current fate and risk assessment methods and identify improvements required for a scientific assessment of ENPs at an early stage.

This study will address; 1) Design, tagging and manufacture of ENPs; 2). Analysis of ENP interactions with abiotic and biotic entities; 3) Generating predictive models for ENP exposure in waters and sludge-amended soils; 4) Studying the fate and behaviour of ENPs through wastewater treatment ; 5) Determining

acute and chronic ecotoxicity; 6) Assessing effects of physico-chemical properties on ENP bioavailability; 7) Defining mechanisms of uptake, internal trafficking, and toxicity; 8) Developing spatial RA model(s); and 9) Improving understanding of ENP risks Methodology

(Web: http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_LANG=EN&PJ_RCN=11268644&pid=0&q=4A431954F4A8C66B88BE665C45A266E0&type=sim).

NANOHOUSE: Life Cycle of Nanoparticle-based Products used in House Coating.

EU Research Framework Programme 7. Start date:2010-01-01, End date:2013-06-30.

The objective is to create a holistic and prospective view on the Environmental Health and Safety (EHS) impacts of nanoproducts used in house building, namely paints and coatings. The latter are using relatively high amounts of Engineered NanoParticles (ENPs) such as nano-Ag and nano-TiO₂ which will be investigated. A new Life Cycle Thinking (LCT) approach will be developed gathering two complementary aspects: Investigation of risks and opportunities during the product life cycle as well as Life Cycle Analysis (ISO 14040). LCT will collect information on EHS impacts throughout all life cycle stages of the nano-products, identifying the data gaps which will guide the research work. The first task will be to quantify the actual sources of ENPs during the use and ageing of actual coatings (weathering, renovation, demolition and final disposal).

The project will then characterize the environmental compartments significantly impacted by ENPs released from nano-products, measure ENPs concentrations and states in those compartments, and investigate their fate in order to increase the knowledge regarding exposure to ENPs with a view to reducing the risks. NanoHOUSE will study the environmental behaviour and the toxicological effects of actually released ENPs (aged ENPs) and compare them with pristine ENPs. Finally, NanoHOUSE will improve the solutions for end of life treatments regarding ENPs release in the environment. Main outcomes of the project will be a scientific risk evaluation of nano-products used in building, solutions to improve their competitive and sustainable development by decreasing their potential to release ENPs, and contributions to standard tests for their certification. The NanoHOUSE consortium involves 5 research/academic partners and 4 industrial manufacturers of which 1 SME

(Web: http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_LANG=EN&PJ_RCN=11268654&pid=0&q=02943F90D75AFE5CA87B1EB11E33D935&type=sim).

Nanex: Development of Exposure Scenarios for Manufactured Nanomaterials.

EU Research Framework Programme 7. Start date:2009-12-01, End date:2010-11-30.

The objective is to develop a catalogue of generic and specific (occupational, consumer and environmental release) exposure scenarios for manufactured nanomaterials (MNs) taking account of the entire lifecycle of these materials. NANEX will collect and review available exposure information, focussing on three very relevant MNs; 1) high aspect ratio nanomaterials - HARNs (e.g. carbon nanotubes); 2) mass-produced nanomaterials (e.g. ZnO, TiO₂, carbon black); and 3) specialised nanomaterials that are currently only produced on a small scale (e.g Ag)).

The exposure information will include both quantitative (measurement results) and qualitative contextual exposure information (risk management measures). We will also review the applicability of existing models for occupational and consumer exposure assessment and for environmental release from these scenarios. We will carry out a small number of specific case illustrations and carry out a gap analyses of the available knowledge and data. Finally, project knowledge will be disseminated to relevant stakeholders, taking into account other relevant activities that are taking place in this field.

(Web: http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_LANG=EN&PJ_RCN=11275710&pid=0&q=BBF165CF3045F30EEB5A1E1739774CC9&type=sim).

LCA TO GO: Boosting Life Cycle Assessment Use in European Small and Medium-sized Enterprises: Serving Needs of Innovative Key Sectors with Smart Methods and Tools.

EU Research Framework Programme 7. Start Date: 2011-01-01, End Date: 2014-12-31.

"LCA to go" develops sectoral methods and tools for bio-based plastics, industrial machinery, electronics, renewable energy, sensors and smart textiles. These sectors have been chosen, as the manufacturers show a high interest in making clear the environmental benefits of their products to customers ("Green industries") and in prioritizing so they can reduce their environmental impacts. This is particularly the case for SMEs. Free webtools ("apps") will serve dedicated needs of these sectors, addressing the specifics of the technologies and implementing parameterised models, such as calculators for energy-break-even-point of photovoltaics, Product Carbon Footprints (PCF) based on technology parameters of printed circuit boards, and Key Environmental Performance Indicators (KEPIs) for smart textiles. Selected Product Category Rules will be developed to provide a robust LCA guidance for SMEs. Practically, the project website will provide an exchange of scientifically validated data templates, to assist SMEs to pass the right questions to their suppliers. Carbon Footprints are a perfect entry point for SMEs to LCA strategies. Thus, implementation of an SME-compatible PCF methodology is a key element of the project.

The approaches will be tested in 7 sectoral case studies, involving suppliers, end-product manufacturers and engineering companies. Inter-linkages between the sectors (on a technical and data level) will be thoroughly addressed. A broad dissemination campaign includes a mentoring programme for 100 SMEs, which will act as showcases for others, boosting use of LCA approaches among European SMEs at large. RTD and dissemination activities will be complemented by policy recommendations and liaison with standardisation activities. The web-tools, being compatible with ILCD data and other external sources, will be made available as open source software, to be adapted to other sectors. The project will have a direct impact on sectors representing nearly 500,000 SMEs.

(Web: http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&RCN=97146).

ENFIRO: Life cycle assessment of environment-compatible flame retardants (Prototypical case study)

EU Research Framework Programme 7. Start Date: 2009-09-01, End Date: 2012-08-31.

ENFIRO offers a prototypical case study on substitution options considering nanoclays for BFRs resulting in a comprehensive dataset on viability of production and application, environmental safety, and a complete life cycle assessment. Dissemination will ensure the project results to arrive at policymakers' desks. The ENFIRO consortium is a unique collaboration between industries, SME's and universities with a wide variety of scientific disciplines. ENFIRO will contribute to the phasing out of BFRs as proposed in the European Water Framework Directive. The approach and the results of ENFIRO will be useful for similar substitution studies, e.g. in REACH. Following a study on literature and industrial information, and prioritizing, three flame retardant (FR)/product combinations will be selected (e.g. metal-based FRs, phosphorus-based and Nanoclay-based FRs in printed circuit boards, paints and foam). These will be studied for environmental and toxicological risks, and for viability of industrial implementation, i.e. production of the FR, fire safety and application of the FR into products (electronics, furniture, paints, foams, etc.).

All information from these tests will be used for a risk assessment. The outcome of that assessment will, together with socio-economic information be used in a complete life cycle assessment. The project will

follow a pragmatic approach, avoiding final recommendations on environment-compatible substitution options that would not be viable for implementation by industry. A Substitution Information Exchange Forum with members representing FR users (large industries) has been invited to guide this project.

(Web: <http://www.enfiro.eu/index.html>; http://cordis.europa.eu/fetch?CALLER=FP7_PROJEN&ACTION=D&DOC=1&CAT=PROJ&RCN=92068; or <http://ec.europa.eu/research/endocrine/pdf/enfiro.pdf>).

ECOPHARMABUILDING: Eco-Innovation of Pharmaceutical Buildings Supporting in Sustainable LCA Tools

(ECO/08/239082) done within the scope of the CIP-EIP-Eco-Innovation 2008 project.

The main objective of the project is to build a sustainable building for pharmaceutical activities that will respect the three dimensions of sustainability. This eco-designed building is belonging to the first phase of PRAXIS complex building. This eco-building will be the pilot phase of the complex. Amongst the other objectives to identify, describe and present a detailed description of the PRAXIS Pharmaceutical S.A. production processes including micro-and nanotechnologies. The production processes of this pharmaceutical company will be used as a case study for the development, within this project, of an open source LCA tool that can ultimately be used by each pharmaceutical company to analyze their processes. This LCA tool can be used to perform an input-output analysis of pharmaceutical processes, to evaluate their potential environmental impacts, to perform a sustainability assessment, and also to identify opportunities for improvement (Web: <http://www.ecopharmabuilding.com/>).

BUSINESS AND INDUSTRY ADVISORY COMMITTEE TO THE OECD (BIAC)- NANOTECHNOLOGY INDUSTRIES ASSOCIATION (NIA)

Benefits of Nanotechnologies: Valuing Nanotechnologies- Methodology for estimating, in monetary terms, the benefits of nanotechnology.

This project recently commenced by the NIA will address this issue by developing a methodology to quantify the value of a nanotechnology in comparison to conventional products. The methodology will be flexible; enabling specific geographic regions or industry sectors to be analysed in order to identify where the monetary benefit of the nanotechnology resides. It will also describe how the benefits are apportioned between users, manufacturers and the wider economy/environment. On completion of the project the results and findings will be presented to the OECD to encourage developing a consistent methodology for valuing nanotechnology.

(Web: <http://www.nanotechia.org/content/activities2/current-projects/valuenanotech20100400/>).

Commercialisation: Best Practices for IPR and Technology Transfer in Nanotechnology Developments.

The Nano2Market project aims to develop and provide guidelines for technology transfer, rules for IPR and license agreements and license models in nanotechnology development projects. To achieve these objectives the project team is constructing value chains of the transfer of each technology, and aims to analyse specific representative applications of the different areas of the nanotechnology R&D European strategy: medical applications, information technologies, energy, materials, manufacturing, instrumentation, food, environment and security. (for more information about the Nano2Market project, follow these links: <http://www.nanotechia.org/content/activities2/current-projects/niaprojectnano2market/> or <http://www.nano2market.eu/>).

The objective is to classify the technology application areas of nanotechnologies into different clusters according to: development cost, time-to-market, complexity of licensing, etc. In parallel, the actual and forthcoming market will be mapped and analysed according to competitiveness, geographical area, development potential, risks, etc. Specific data mining tools will help to conclude the key worldwide actors of development and commercialisation of the different technologies. Actual IPR cultures and technology transfer rules will be listed according to the features of their market and technology; matching the IPR and technology transfer models with the concluded value chains and market and technology maps will result in the recommendation of best practice business models and efficient rules for technology transfer. In agreement with the OECD WPN, the findings of the Nano2Market project final Nano2Market Dissemination event will be shared with the OECD WPN.

Market-Specific R&D: Transforming the future of heat management (NanoHex).

The world's largest collaborative project for the research and development of nanofluid coolants, NanoHex comprises of a consortium of 12 leading European companies and research centres. It has been funded by a €8.3M Seventh Framework Programme grant, together with investment from the consortium themselves. NanoHex aims to develop and optimise the processes for the production of high performance nanofluid coolants for use in industrial heat management. As well as an analytical model that will predict the nanofluid's thermal performance.

Using both Risk and Life Cycle Assessments, NanoHex will also evaluate the health and safety of nanofluid coolants and their potential impact on the environment. These results will then form an important component in assessing the final products overall economic viability. Ultimately, the project will develop two different demonstrators for the cooling of Data Centres and Power Electronic Components, in order to illustrate the viability of using such nanofluids to reduce energy consumption and operating costs, cut carbon emissions, extend product reliability and enable the development of more sustainable processes and products.