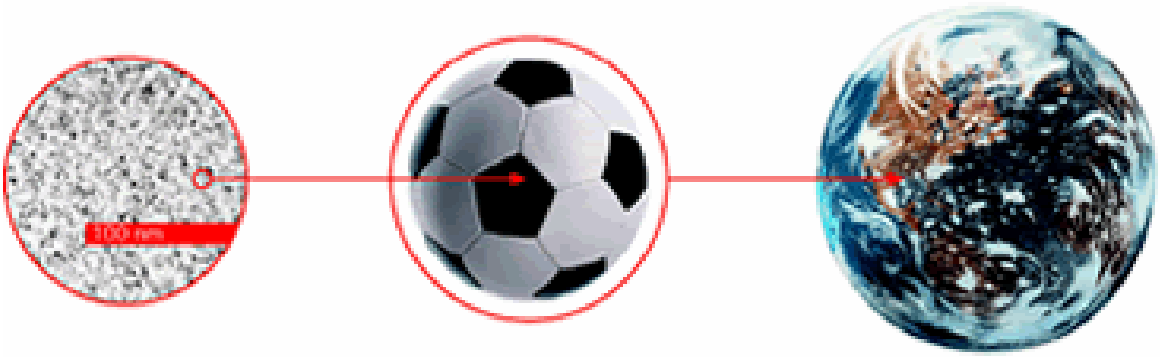
Nanotechnologies: Helping to address Europe's Grand Challenges

Annual Report for the Public May 2011

Europe faces a number of Grand Challenges such as an ageing population, climate change, environmental degradation, energy, water and food shortages, and public health issues with an overriding challenge of ensuring a globally competitive eco-efficient economy. The solutions to these challenges are multi-faceted but technology may play a significant role. In this report we will highlight some of the potential solutions provided by nanotechnology developments determined through the analysis of the ObservatoryNANO project

What is nanotechnology?

A nanometre (nm) is one-billionth of a metre. It is difficult to imagine just how small this is so think of a human hair….it has a diameter of 10 000 nanometres! At the nanoscale (around 100 nanometres or less) materials can show marked changes in optical, magnetic, electrical, chemical and physical properties; facts that have been known for some time but are only recently being exploited. Such properties mean that nanotechnology is a very exciting area and may help to find solutions to medical, social and environmental problems which adversely impact upon the quality of life of the people of Europe. Additionally successful exploitation of nanotechnologies will increase industrial competitiveness and boost the European economy.



The size of a typical nanoparticle is...

...to a football as a football is...

...to the earth

What does the ObservatoryNANO do?

The ObservatoryNANO is a four year project funded by the European Commission (EC) to provide information and analysis of new nanotechnology developments to European policy and decision makers. It is not just the scientific and economic information we provide but the project partners also look at areas such as health & safety concerns, ethical issues, and regulations which will allow for the responsible and successful development of nanotechnologies.

More information on the project can be found at our website;
www.observatory-nano.eu
Or by contacting the project coordinator, Dr Eleanor O'Rourke
eleanor.orourke@nano.org.uk

Highlights from the ObservatoryNANO 'Briefings'

During the last year the main output of the ObservatoryNANO has been in the form of four page Briefings, which look at a nanotechnology development and how it can impact on science, the economy, and the EU citizen. Additionally any issues, such as risk to human health or economic factors, which may impede the development reaching the market are assessed. In the next few pages summaries of the available Briefings are provided.

BRIEFING NO 1: BIODEGRADABLE FOOD PACKAGING

The volume of waste generated by the European agrifood sector is of increasing concern; in fact Europe's fruit and vegetable industries generate around 30 million tonnes of waste a year. Numerous initiatives aimed at reducing agricultural waste (or finding novel uses for it) have been launched. For example the UK Government recently stated that within 10 years, 75% of all UK household waste should be recycled or composted.

Food packaging waste is predicted to increase as a result of an ever increasing demand for convenience food, and individual wrapping of fresh produce (such as fruit). Plastic packaging (useful for its water-tightness and rigidity) has been designed with little consideration for disposability or recyclability, resulting in concerns over the environmental impacts when they enter the waste stream. This BRIEFING outlines a promising area of nanotechnology that may contribute to the management of food packaging waste , adding value to the growing demand for biodegradable food packaging.

BRIEFING NO 2: PHOTOCATALYSIS FOR WATER TREATMENT

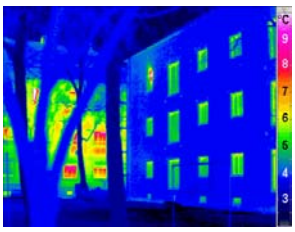
Water pollution is a concern for nearly half of the European population, as indicated by the EU25 barometer. The European Union addresses this concern in the EU Water Framework Directive, which sets quality objectives for water protection. The EU is also committed to the UN Millennium Development Goals (MDG), one of the targets of which is to halve the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015.

The challenges in treating waste- and drinking water depend on the origin of the water. Problematic substances in wastewater can include organic matter and/or different trace contaminants. Industrial wastewater may additionally contain heavy loads of metals or organic compounds. In drinking water production the contamination with microbes needs to be addressed – especially in developing countries but also for remote locations without access to a centralized drinking water supply.

Solar photocatalysis had been identified as the main technology breakthrough for water treatment and purification, particularly in developing regions. First pilot projects are now being carried out. Photocatalytic systems in advanced oxidation processes (AOPs) may complement existing techniques in the removal of trace contaminants. Such systems are commercially available e.g. for the disinfection of swimming pools. This BRIEFING outlines the social and economical relevance of photocatalysis, provides background information on the technology, and highlights further challenges that remain to be addressed.

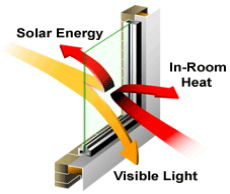
Highlights from the ObservatoryNANO 'Briefings'

BRIEFING NO 3: NANO-ENABLED INSULATION MATERIALS



This BRIEFING provides an overview of the building insulation market, and how nanotechnology is contributing to it. Through nano-porous materials, nano-coatings and nanoparticle enhanced paints, nanotechnology can help society to save energy, and increase comfort and wellbeing within buildings.

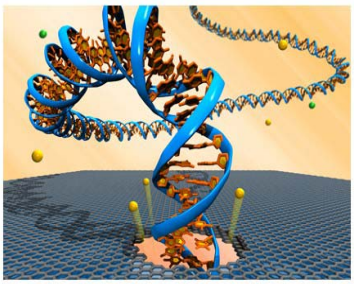
The construction sector is the largest energy consumer (40%), and the main contributor to greenhouse gas emissions (GHG), at over 36% in the EU[1]. Around 80% of construction-related energy consumption and GHG emissions is linked to the energy use within the building over its lifetime, whereas only 20% is linked to energy used to produce and transport the materials used in the building. A breakdown of the building use energy consumption shows that heating, ventilation and air conditioning (HVAC) accounts for approximately 36%. As a result, HVAC represents some 10% of EU's energy consumption and greenhouse gas emissions[2].



However, buildings are generally long-lasting, with average lifetimes of greater than 60 years. This makes it difficult to drastically improve the energy efficiency performance of the entire European building stock only through applying superior insulation and thermal management technologies to new buildings. To have a substantial impact within a shorter (10-20 year) timeframe, existing buildings must be upgraded (retro-fitted) in terms of their thermal performance.

BRIEFING NO 4: NEXT GENERATION SEQUENCING

DNA sequencing technologies over the last three decades have been based on principles first developed in the mid-1970s. Subsequent improvements have led to an increase in the length of DNA fragments able to be read and a move away from radioactive labelling towards detection using fluorescent markers.



Electric fields push tiny DNA strands through atomically thin graphene nanopores that ultimately may sequence DNA bases by their unique electrical signature. (Credit: Robert Johnson/Temple University)

Next generation sequencing has taken some of the later developments of this early method, involving techniques such as "shotgun cloning" and computer based sequence fragment assembly, and has added another dimension in terms of high throughput technologies that can parallelize the process, integrating reactions at the micro- or nanoscale on chip surfaces, and which produce thousands or millions of sequences at once. These high-throughput sequencing technologies are intended to lower the costs of DNA sequencing far beyond that which is possible with earlier methods.

This dramatic change in throughput has been achieved by the direct application of nanotechnology allowing the miniaturisation of the process to the extent. The output produced by these new sequencing technologies is such that even Moore's Law is struggling to keep pace with the challenges of storing and processing the swelling torrent of data produced. These rapid advances in output along with falling costs are expected to eventually allow a rapid and cost-effective sequencing of the personal genome. This, in turn, will have a strong impact in medicine in the context of developing personalised treatments based on the genetic background of the patient. Such developments in sequencing technology are therefore likely to have a great impact on society in general.

BRIEFING NO 6: NANO-ENABLED AUTOMOTIVE PLASTIC GLASS

Source: Daimler AG

Driven by the need to reduce vehicle weight, the desire for more design freedom, and for higher levels of safety, the automotive industry has been investigating the substitution of mineral glass windows by polymers (more specifically polycarbonate) glazing for decades. However, until recently some key performance specifications had not been reached; scratch resistance and long term ultraviolet (UV) resistance remained challenges. Recent advances involving nanotechnology are helping PC window developers to overcome these challenges. Due to these advances the automotive sector expects that in 2020, 20% of automotive glazing will be produced from polycarbonate. Hence, global polycarbonate revenues are expected to experience exponential growth of PC in automotive given market indications from 2008. This BRIEFING explains how advances in nanotechnology using nanoscale additives to create compounds with new properties can improve the abrasion resistance and weatherability of PC glazing, and therefore contribute to the penetration of polycarbonate glazing in the automotive industry.

BRIEFING NO 7: NANO-ENABLED PROTECTIVE TEXTILES

Source: SmartGarmentPeople

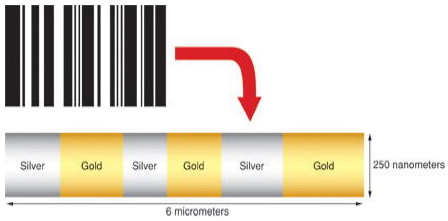
Rising health and safety concerns for those exposed to dangerous environments or high risk professions has increased demand for improved protective apparel and accessories. Protective textiles are part of the Personal Protective Equipments (PPE) family and represents a specific area of the advanced technical textiles sector, a strongly growing market for the textile industry, satisfying an increasing demand for high performance requirements. Personal protective textiles are produced with the aim of eliminating or minimising the risk of injuries, accidents and infections, acting as shields against chemical, biological and nuclear hazards, high temperatures and fire, sharp objects, and ballistic projectiles.

Protective textiles have been selected by the European Commission as one of the areas of the Lead Market Initiative for Europe, aimed at creating an innovation-friendly market framework to re-launch conventional industrial sectors and reduce time to market of new goods and services. In this context, nanotechnologies may play a fundamental role. Novel surface treatments and coatings, nanocomposite and nano-scale fibres, and functional nanoparticles offer textile products providing improved levels of protection together with a lower weight, higher comfort, new or multifunctionalities, or more environmentally friendly processes. The use of dynamic materials integrated in clothing can enable safety products to react to chemicals, biological agents, or changing external conditions. Smart materials combine electronics with textiles allowing for tracking of the wearer, monitoring of physiologic parameters, and energy provision for communication functions. This BRIEFING, that follows five reports devoted to the nano-enhanced textiles[1], summarises the advantages offered by nano-enabled technical textiles in the protective textiles sector.

Highlights from the ObservatoryNANO 'Briefings'

BRIEFING NO 8: NANO-ENABLED ANTI-COUNTERFEITING

Counterfeiting is a global phenomenon, affecting individuals and communities in small villages and major cities right up to big retail stores and pharmaceutical companies. The dual impact of globalization and growth of internet trade has made the problem considerably more acute. Counterfeit products circulate globally via unregulated channels but can also enter legitimate supply chains. In many cases it is very difficult to distinguish them from genuine products.



At present counterfeiters are able to copy most anti-counterfeiting technologies within 18 months. As a result an estimated 7-10% of all goods sold worldwide in 2007 were counterfeit at a cost of ca. €450 billion. Industry segments for which counterfeits are a significant problem include pharmaceuticals, airplane parts, auto parts, and designer clothing, among others. Recent developments in nanotechnology and nanomaterials have enabled significant improvement in the field of anti-counterfeiting measures. However, their implementation may require the development of new policy.

This BRIEFING outlines promising developments with strong potential to create new technology platforms for anti-counterfeiting applications, adding value to the growing demand to reduce citizens' health and security risks of using counterfeit products and industry aspiration to reduce revenue losses associated with counterfeiting activities.

BRIEFING NO 9: NANOTECHNOLOGY FOR FLAT PANEL DISPLAYS

Display devices play a critical role in information sharing as they are used in our everyday life in different applications. Cathode ray tubes have dominated the display industry for over 70 years but the demand for better quality devices has promoted technology development. Consumers call for suitably priced displays with improved features in thinness, brightness, contrast ratio, viewing angle, longevity, size and reduced weight and power consumption. Nanotechnology, an emerging approach to upgrade flat displays, improves the performance and quality while taking environmental aspects into account. It also provides novel features such as foldability and flexibility. Several competing display technologies have recently emerged to satisfy the needs of the display industry. Each of these emerging display technologies has their advantages and disadvantages and none of them provides all the required properties.

BRIEFING No 10: APPLICATIONS OF PHOTOCATALYSIS

Both the technological and economic importance of photocatalysis has increased considerably over the past decade. Improvements in performance have been strongly correlated to advances in nanotechnology; for example, the introduction of nanoparticulate photocatalysts has tremendously enhanced the catalytic efficiency of specific materials. A variety of applications ranging from anti-fogging, anti-microbial and self-cleaning surfaces, through to water and air purification and solar induced hydrogen production, have been developed and many of these have made their way into commercial products. However, extensive research continues to further optimise this technology and to widen the spectrum of potential applications. Research and application foci include anti-stick or anti-fingerprint coatings, soil repellency, and decomposition of organic matter such as microbes or fat.

Highlights from the ObservatoryNANO 'Briefings'

BRIEFING No 11: NANOSENSORS FOR EXPLOSIVES DETECTION

The spread of terrorist events over the globe in the last decade has emphasised the importance of detecting concealed explosives and led to calls for new advanced technologies to protect the public. Because most explosives release little vapour, it is not possible to detect them effectively by methods widely used on other chemicals. Detecting explosives is a very complex and costly task because of a number of factors, such as the wide variety of compounds that can be used as explosives, the vast number of deployment means, and the lack of inexpensive sensors providing high sensitivity and selectivity simultaneously. High sensitivity and selectivity, combined with the ability to lower the production and deployment costs of sensors, is essential in winning the battle on explosives-based terrorism. Nanotechnology based sensors have strong potential for meeting all the requirements for an effective solution for the trace detection of explosives. This BRIEFING outlines the social and economical relevance of nano-enabled technologies for the detection of explosives in security applications, provides background information on the technology, and highlights further challenges to be addressed.

BRIEFING No 12: ORGANIC PHOTOVOLTAICS

The development of clean alternatives to fossil and nuclear energy is vital for the growth of sustainable economies. One of the most attractive alternatives is photovoltaic (PV) conversion, the possibility to harvest solar energy. Among the different technologies already available to directly convert solar light into electricity, organic photovoltaics (OPV) - offer several possibilities such as a low weight and a high compatibility with flexible substrates. The fabrication process itself is potentially very versatile, low cost and compatible with mass production via printing processes. For now, the OPV market is at an early stage of development with the first products being commercialised for niche markets. The low efficiency and short lifetime of OPV hinders its competitiveness against inorganic solar cells. The European position is relatively good in the RTD landscape but also on the industrial side with the presence of several start-ups and large companies (especially chemical companies) focusing on certain segments of the value chain. However, Asian companies hold a strong position in the terms of Intellectual Property Rights (IPR). This BRIEFING will discuss the need for breakthroughs in PV, technology developments in OPV, their potential impacts on the economy, industry and society, and will also look at the challenges these technologies are facing.

BRIEFING No 13: NANOSTRUCTURED MEMBRANES FOR WATER TREATMENT

Potable water is a precious resource as without it human life is not possible. The increasing world population is a critical issue since it leads to higher water demand, increased wastewater production and increased stress on surface water. This challenge requires innovative solutions for the production of potable water, wastewater treatment and water recycling. Membranes with nanosized pores have been in use by the water industry for decades and are an established method for the treatment of contaminated water and drinking water production. This BRIEFING outlines the most important application areas of nanostructured membranes (NSM), their economic and social impact, and challenges that remain to be addressed. It further points out open issues regarding the definition of nanostructured materials, which have direct implications for policy making and highlights the difference between nanostructured membranes and membranes incorporating nanoparticles.

Highlights from the ObservatoryNANO 'Briefings'

BRIEFING No 14: FROM MICROSCOPE TO NANOSCOPE

The physical dimensions of nanostructures are far below the diffraction limit of visible light; preventing nanoparticles from being directly imaged by optical microscopy for example. Instead, utilisation of X-ray and electron based methods are widely required. Appropriate techniques are established in R&D, and even visualisations down to the single atom level have been realised[1]. Other nano-analytical characterisation methods are dealing with bulk entities instead of analysing individual structures. However, it is often possible to infer characteristics on the nano-scale out of the bulk properties. This BRIEFING will provide an overview on a number of specific nano-metrology techniques as well as looking at applications in R&D and also those that have already found their way to commercialisation.

BRIEFING No 15: BRINGING DIAGNOSIS CLOSER TO THE PATIENT

Some of the most important challenges for nanomedicine currently include:

- finding ways to translate advances in both technology and the understanding of the pathology of disease into preventive medicine;
- detecting disease at the earliest, most treatable stage;
- decreasing costs to healthcare services and increasing productivity at the same time;
- ensuring the cost of medical technologies is aligned with better patient prognosis;
- finding ways of improving on existing treatments and technologies.

This BRIEFING will examine how the application of knowledge of disease processes at the nano-scale and of nanotechnologies will impact the development of advanced point-of-care (POC) diagnostic devices and the impact that such products will be likely to have on healthcare systems.

BRIEFING No 16: PROVIDING VITAMINS AND MINERALS FOR GOOD HEALTH

Globally, the increase in population is putting pressure on the food sector. Not only have the recent natural disasters caused a price hike in food prices, we see country/continent specific shifts and needs. In Europe we see an ever increasing problem of obesity and malnutrition. Here, cultural trends are leading populations into high fat and high sugar diets with less emphasis on fresh fruit and vegetables, specific cereals and a variety of protein rich and vitamin/mineral rich produce. These are not always readily available, and in some cases key nutrients are difficult to obtain and thus supplements are needed. Alongside the need to promote a mixed diet and a healthier lifestyle, there are certain cases where nutrient supplements are required particularly in poorly soluble compounds.

This BRIEFING discusses how encapsulation provides a promising approach, and R&D expectations point to a real contribution in increasing the bioavailability of nutrients. Moreover, novel processing techniques are indicating that inclusion into processed foods themselves (so called fortified foods) is a means of including these supplements into, without a dramatic shift in, the eating habits of the European population.

The ObservatoryNANO Company Census

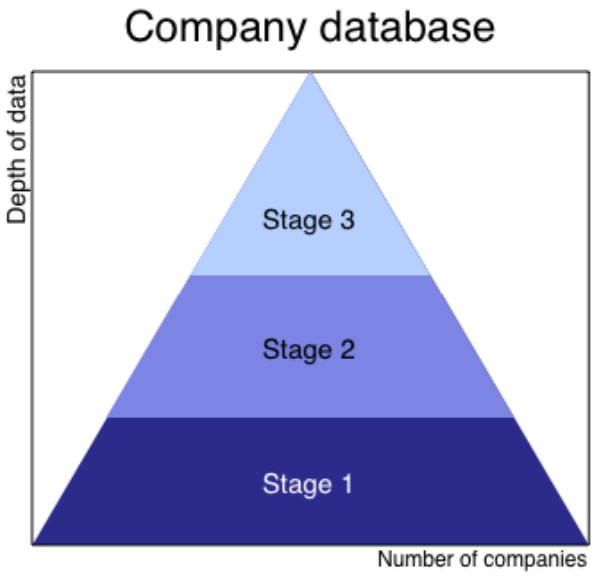
During the last year WP3 (Economic & Market Analysis) has been developing a three stage company survey with the aim of supporting the EC Nanotechnologies Action Plan, which is focused on supporting European innovation. The result will be a database of European companies active in the nanotechnology sector helping guide the future nanotechnology innovation and funding strategies of the EC.

Stage 1

The first stage of the survey took place throughout the latter stages of 2010 and was comprised of quantitative analysis of three key data indicators:

- Patent applications;
- Publications; and
- FP7 Funding

This amalgamated data set highlighted European companies active in the nanotechnology field along with some information on their products and geographical location.



Stage 2

This next stage began early in 2011 and concentrated on using desk research based methods to help further enhance the company database with available information.

Stage 3

This stage of the process involved an online 'Economic Impact of Nanotechnology Census', which can be found at www.nano.org.uk/obsnano. During the initial data collection period of February and March 2011 over 100 European companies provided information on their activities and thoughts on impacts of funding, barriers to development and regulations and standards.

The Outcome

The results of this extensive survey activity will be presented in a '***State of Nanotechnology Report***', which will also encompass relevant analysis from ethical, societal, risk, and regulations work packages to be presented to the EC in September/October 2011.

The initial findings of the report will be presented during an ObservatoryNANO workshop taking place on Wednesday 1st June 2011 during the EuroNanoForum 2011 event in Budapest. Here policy makers will be given the opportunity to learn about how nano-enabled solutions are developing and may help address some of Europe's grand challenges but also information from 'on the ground' and how their policies can aid nanotechnology companies to improve innovation and competitiveness.

Reflecting on ethical issues…..

Responsible development of nanotechnology means reflecting on ethical issues and taking into account issues in the public and stakeholder debate on nanotechnology. In year three of the ObservatoryNANO project, WP4 focused on ethical and societal aspects related to two of the ten technology sectors targeted by ObservatoryNANO: ICT and Security. This is the topic of the annual report, to be published in April 2011. This report analyses issues discussed in three domains that are relevant to nanotechnology: ICT and privacy, security technologies and policies, and civil-military dual use of (nano)technology.

Reporting on the views of opinion leaders…..

Three interviews with opinion leaders were also dedicated to nanotechnology, ICT and security: Dr Silvia Venier (RISE and HIDE projects, CSSC, Rome, Italy), Prof Bernd Carsten Stahl (ETICA project, the Montfort University, UK) and Prof Ashok Vaseashta (NUARI, USA).

For all ethical and societal issues, online lists of experts and relevant projects, and an overview of literature resources were updated. Relevant ethical and societal aspects were contributed to ObservatoryNANO briefings and fact sheets.

Providing scientists with a tool for ethical reflection…..

The ObservatoryNano Ethics Toolkit was tested in a number of conferences and workshops for nano scientists and engineers by Marc Pavlopoulos in France (Grenoble, Saclay CEA), Russia and Switzerland, and by Alexei Grinbaum in Japan. Ethical issues in nanotechnology are most often thought to concern only the general public. However, scientists and researchers are very much concerned by questions of responsibility and by the social impact of their research in general; such questions may dwell deep into their commitment to research in general. The Ethics Toolkit provides nanoscientists with a quite unique resource to help them clarify and strengthen their judgments and positions on ethical debates and questions raised by their own research.

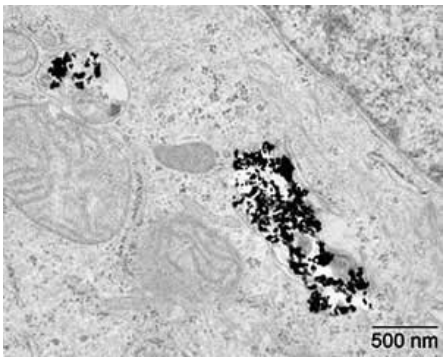
Future work…..

The annual theme for the final year of the ObservatoryNano will be “Communicating nanoethics”. This theme has already been launched in the form of an online interview with the President of the Dutch Societal Dialogue on Nanotechnology: Professor Peter Nijkamp (VU, Amsterdam) who pleads for going “Onwards Responsibly with Nanotechnology.”

For further information click ‘Societal Issues’ at www.observatorynano.eu

Is nano safe?

Over the last year ObservatoryNANO partners have completed analysis of nanotechnology developments over the ten technology sectors investigating the environment, health & safety risk of nanoparticles and nanomaterials at a number of stages through what is called a life-cycle analysis:



1. Risk during the manufacturing or production of the nanomaterials, particularly in terms of occupational exposure;
2. Risk to humans using the resulting product, considering effects of wear and tear;
3. Risk to environment during product use;
4. How the product can be disposed of or recycling and any potential risks to humans or the environment.

All the reports and also details of the variety of organisations involved in nanotechnology can be found by clicking ‘HSE & Risk’ at www.observatorynano.eu

Another aspect of the ObservatoryNANO work is looking at regulations and standards governing how nanotechnology is measured and assessed. In spite of the attention and activity in the field, specific regulatory actions for nanotechnology-related products remain rare. For some technology sectors, such as for medical technologies, existing regulatory schemes are considered quite adequate to deal with nanotechnology-related solutions, although there is still a requirement for improved EHS data. In other cases, such as cosmetics and foods, on the contrary, existing regulations are considered inadequate and at least a revision of them is considered necessary.

The European Commission, together with other industrialised nations, is sharing this position, highlighting that, with necessary adaptations for nanotechnologies, existing regulatory schemes can go some way to regulating this emerging field without constraining growth too much. With this in mind, the focus is more on the improvement of instruments to ensure compliance with existing legislation.

Codes of conduct and risk management systems are measures that can have an important role to cope with current uncertainties about the impact of nanotechnologies and during the redefinition of existing hard regulation, as well as to raise trust on their use through the creation of a culture of responsibility.

The demand for nanoregulation remains high in the agenda for the responsible developments of nanotechnologies is considered instrumental to their use. Nevertheless, the remaining gaps in the scientific knowledge and different positions and stances of regulatory agencies around the world, suggest the introduction of new laws specific for nanotechnology cannot be expected in the short term.

Observing the Observers

Over the last year, project partners from the Technical University of Darmstadt (TUD) have followed different approaches in its efforts to reflect upon the characteristics of the ObservatoryNANO project and other observational initiatives. The aim is to formulate recommendations for the structure of a future permanent European observatory on nanotechnologies to continue the work of the ObservatoryNANO. This work builds upon the previous WP7 reports by TUD, *"Review and report of existing and proposed observational initiatives"* (March 2009) and the review and report update from March/April 2010.

The focus concerning other observational initiatives was broadened, other initiatives were added for reasons of comparison; for example the Joint Research center (JRC), the President's Council of Advisors on Science and Technology (PCAST, USA) and nano related working parties of the OECD.

TUD also made efforts to refine the grid of observational categories developed in the first report in order to highlight differences concerning finances, structure, foci, modes of observation and target groups of an observatory. Especially interesting are the interdependencies between the different categories. An interesting preliminary finding is that the integration of different modes of observation (e. g. data collection and horizon scanning) is a challenge for most observatories but at the same time very valuable for customers, e. g. policy makers.

Particular attention was (and is) paid to questions concerning a 'theory of observation' in this context, and the role an observatory can play in the landscape of governance in the face of non-knowledge, and a shift from 'classical' regulation towards different forms of 'soft regulatory' measures. Input from observational initiatives becomes more and more valuable for governance issues in the context of new and emerging technologies. TUD analyses what 'observing' means in this context. Is it more than a passive collecting of data, and if yes – are there characteristics of intervention to be found? What role could an observational institution play in broader concepts of bringing transparency to the collective experimentation of society (society as laboratory)?

The Nanometer: a tool for business

The NanoMeter is a tool for the assessment of applications that are enabled by nanotechnologies. It is being developed in order to help businesses to identify opportunities and risks of single nano-applications that are currently under development or already on the market.
It covers the aspects health and environment, energy and resources, precaution, privacy as well as further ethical and societally relevant issues, i.e. issues that go beyond standard product assessments.

Usage in practice

Starting from a nanotechnology-enabled product, ingredient or application, the users answer questions that guide them through relevant opportunity and risk areas. If needed, "further information" links can be followed. After about 30 minutes the users get the results, condensed in a PDF document.

Results

The use of the NanoMeter results in:

- the identification of knowledge gaps.
- an overview on aspects where the application could possibly be improved.
- a basis for measures to ensure performance, acceptance and, possibly, market success.

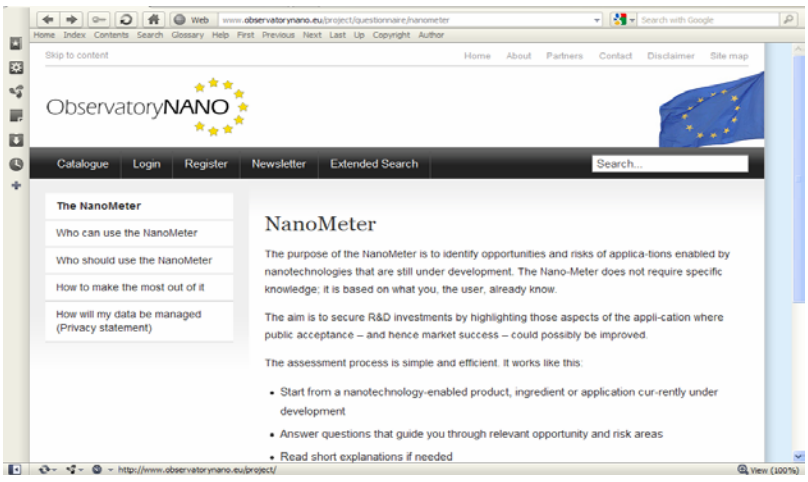
Purpose

The purpose of the NanoMeter is to make important findings of nanotechnology research practically applicable for businesses. Many nano-applications are still under development or have just recently been put onto the market. The NanoMeter makes developers and business people understand which risks and also opportunities - that a single application may bring with it - need a closer look. The NanoMeter gives guidance to experts, offering them to make their knowledge, experiences and scientific or personal insecurity regarding a specific application more explicit, and, at the same time, makes the findings of the ObservatoryNANO in specific technology sectors easily accessible.

The result of the NanoMeter does not rank an application nor can it point at risks and opportunities that are likely to come. It only highlights areas where actual knowledge, risk assessment procedures and internal business governance structures lack attention. The results are presented in a way supporting individuals to reflect on their own knowledge and practices and to enable them to easily share their findings and perceptions with colleagues or partners.
online available at;

www.observatorynano.eu/nanometer

Preliminary version! Any feedback for improvement is highly welcome.



The final year for the ObservatoryNANO……

During the final year of the project we will be continuing to produce regular Briefings on topics such as:

- Sensors in food production and processing
- Nanomaterials for resource efficiency
- Reducing friction in combustion engines
- Nanosorbents for water treatment
- Construction textiles
- Antimicrobial coatings
- Nano-enabled solutions for an ageing population
- Fuel additives
- Nano-enhanced membranes for water treatment
- Nano-enhanced cement additives

And many more! All our Briefings can be found at www.observatorynano.eu

Additionally we will continue with our census of European nanotechnology companies to further develop our knowledge of how nanotechnology is developing and what issues are hampering innovation and commercialisation. In addition our business tools will be tested and rolled out fully.

Our analysis on societal issues, health and safety, and regulations & standards will also continue throughout the year.

All ObservatoryNANO output can be found at www.observatorynano.eu or by contacting the project coordinator Eleanor O'Rourke at Eleanor.orourke@nano.org.uk

Where to find more information on Nanotechnology…..

General information on nanotechnology
www.observatory-nano.eu
www.nano.org.uk
www.nano.org.uk/educationtree
www.nanoforum.org
cordis.europa.eu/nanotechnology/

Ethical, Legal & Societal Aspects
www.nanoyou.eu
www.timefornano.eu
www.ecsite.eu/?cat=12255

Health & Safety of Nanotechnologies
www.safenano.org
www.omnt.fr
icon.rice.edu/research.cfm