Third Nanotechnology Stakeholder Dialogue

Introduction

Nanotechnology potentially has widespread industrial applications, including in food products, processing and packaging. As an innovative and progressive sector, the European food and beverage industry is actively involved in national, EU and international discussions concerning nanotechnology and is closely following its implications for the food industry. To contribute to the European debate, CIAA holds an annual **"CIAA Nanotechnology Dialogue"**, which gathers policymakers, industry representatives, scientists and consumer organisations. This report summarises the Dialogue which was held in Brussels on 23 March 2010.

1. Policy aspects

1.1 European Level

At European level, different rules apply to the use of nanotech in food products and in food contact materials.

1.1.1 Nano in food products

The revision of the EU regulation on novel foods is expected to clarify the rules that apply to nano in food products. **Dr. Jean François Roche** from the **European Commission's Directorate General for Health and Consumers (SANCO)** provided an update on the status of the revision. The Council adopted its first reading position on 15 March 2010. The Parliament started its second reading on 24-25 March 2010 and will have three months to adopt its second reading position. Dr. Roche stated that the regulation could be finalised as early as July 2010, though further negotiations may be necessary. Nano is not the only element under discussion. He stated that the adaptation of the Regulation to the Lisbon Treaty has important implications, because of the Treaty's changes to the comitology procedures and the importance of the latter in the implementation of the Novel Foods Regulation.

The Parliament and Council have agreed on the following definition for nanomaterials within the revised Novel Foods Regulation: "any intentionally produced material that has one or more dimensions of the order of 100 nm or less or is composed of discrete functional parts, either internally or at the surface, many of which have one or more dimensions of the order of 100 nm or less, including structures, agglomerates or aggregates, which may have a size above the order of 100 nm but retain properties that are characteristic to the nanoscale. Properties that are characteristic of the nanoscale include: (i) those related to the large specific surface area of the materials considered; and/or (ii) specific physico-chemical properties that are different from those of the non-nanoform of the same material".

From a safety and risk management perspective, the Commission considers it important to include substances that behave as nanomaterials and have nano properties. The Commission also considers that the definition of nanomaterials must fit with international standards. Even though the definition to be included in the revised Novel Foods Regulation is already agreed, the Commission intends to develop an overarching "working definition" of nano, applicable across the board but to be adapted in individual pieces of legislation to fit the specific needs of different applications. This "working definition" is being developed by a Commission working group composed of various Directorates-General, and the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) has been asked to provide scientific input on the definition[1]. SCHENIR's draft opinion is expected in June

[1] http://ec.europa.eu/health/scientific_committees/emerging/docs/scenihr_q_024.pdf

2010 and may be followed by a consultation. The Commission plans to finalise the working definition by the end of 2010.

Against this background, the Commission would like to maintain the possibility of revising the definition of nanomaterials in the Novel Foods Regulation through a delegated or implementing act (new comitology procedure).

Regarding labelling, the Parliament has called for the mandatory labelling of nano in the Novel Foods Regulation and in the proposal for a Regulation on Food Information to Consumers. While the Commission does not yet have a formal position on this question, it considers that if labelling is deemed necessary, this provision would make more sense in the horizontal legislation on Food Information to Consumers. The issue will be debated between the EU institutions during second reading.

There is a perceived risk that applications submitted for a risk assessment opinion from the European Food Safety Authority (EFSA) will not be complete enough for EFSA to deliver an opinion. The Commission has thus asked EFSA to provide guidelines for the risk assessment of nanomaterials. Dr. Roche stated that the definition of nanomaterials is not expected to have a significant impact on the guidelines.

The Commission is drafting a new Nano Action Plan 2010-2015, which will identify priorities for the development of nanotechnologies. The Commission's top priorities are safety and innovation. DG SANCO would like the establishment of a mandatory register for all nanomaterials, not only food-related, to be part of the Action Plan. DG Enterprise is considering organising a public debate about nano, like some Member States have done, but nothing has been confirmed at this stage.

1.1.2 Nano in food contact materials

EU law sets out stringent rules for all food contact materials, regardless of the technology used, stated **Dr. Annette Schaefer** of the **European Commission**. The special rules that apply to plastic food contact materials and active and intelligent materials apply to nano when used for these purposes. A frequently asked question is whether the use of a substance in nano form is authorised if the substance is mentioned in the list of authorised substances for plastic food contact materials. Dr. Schaefer explained that the nano form is only authorised if the data provided for the risk assessment included the nano form, otherwise the nano form is not covered. This clarification will be specified in new legislation for plastic food contact materials which is expected to be adopted by comitology during the summer of 2010. Two examples of substances for which the nano form was included at the time of authorisation are silicon dioxide and carbon black. EFSA has provided scientific opinions for another two nano substances for use in plastic food contact materials: silicon dioxide coating and titanium nitride nanoparticles. In other materials, nano is subject to the general framework regulation on food contact materials, as well as national legislation.

1.2 National activities

1.2.1 UK

An overview of recent UK developments was provided by **Dr. Peter Hatto**, Director of Research at **IonBond** and Chairman of several nano standardisation committees (ISO TC 229, CEN TC 352 and BSI NTI/1). The House of Lords' Science and Technology Committee published a report on Nanotechnologies in the Food Sector in January 2010. The report follows a series of stakeholder consultations in 2009 and contains 32 recommendations related to encouraging the commercialisation of nano in the food sector, filling the health and safety knowledge gaps, regulatory scope and enforcement and effective communication. Dr. Hatto stated that the recommendations are generally good for the food industry; however some recommendations may present a challenge. One challenge may be the recommendation for the mandatory participation of industry in a

confidential database of information about nano research within the food sector. Another challenge may be the recommendation to define nano in the Novel Foods Regulation as all materials under 1000 nanometers that interact differently with the body than the same material of larger dimensions. The report also recommends that the definition of nano exclude materials created from natural food substances, except for those that have been deliberately chosen or engineered to take advantage of their nanoscale properties.

The Government launched the UK Strategy for Nanotechnologies on 18 March 2010 with the aim of supporting the development of nano through innovation and promotion of the use of nano in a safe, responsible and sustainable way. It identifies four areas for action: business, industry and innovation; environment, health and safety (EHS) research; regulation; and the international dimension. Dr. Hatto reviewed actions of relevance to the food industry, which include the establishment of a public list of food products that currently contain nano as part of a scheme to collect information on nano and products containing nano in the UK. Regarding regulation, the Food Standards Agency will monitor the efficacy of the regulation of food additives with respect to nano and will promote a case-by-case approach to further regulation of food contact materials that contain nano. The UK Nanotechnologies Strategy is viewed by many stakeholders, including both industry and consumer groups, as a continuation of the status quo rather than a vision for the future, stated Dr. Hatto.

1.2.2 France

The French government's public, multi-sector debate on nano was presented by **Agnès Davi** from Danone on behalf of the **French food and drink industries association (ANIA)**. The objectives of the debate were to inform citizens about nano and to help the government formulate its strategy. 17 regional meetings were held between September 2009 and February 2010 to address technical, regulatory, environmental, health and safety issues. Due to disruptions, some meetings were cancelled and others were replaced with an online dialogue. While the nano debate covered many sectors, a meeting in January 2010 was devoted to food safety and nano. A frequently asked question was whether nano is already used in food. The response of the French Food Safety Agency (AFSSA), Government and ANIA is that there is no use of nano in food products in the EU at present. Regulations are in place or are soon to be in place to ensure that nano in additives, food contact materials and food products are approved before being placed on the market. A summary report of the French nano debate is expected in April 2010.

1.2.3 Netherlands

Nanopodium[2], a debate initiated in December 2009 by the independent Committee for the Societal Dialogue on Nanotechnology (CMDN), was presented by **Geert de Rooij** from the **Dutch Food and Drink Federation (FNLI)**. The aim of Nanopodium is to exchange ideas and best practice and to stimulate public dialogue about the threats, opportunities and resulting applications. Nanopodium's societal dialogue will be evaluated by the end of 2010 and will be the basis for an Agenda for Nanotechnology which will be presented to the Dutch Government. The public debate is being carried out through television programmes, publications, activities that target high school students, open-mike nights about nano (so-called "science cafes") and other initiatives.

1.2.4 Germany

[2] http://nanopodium.nl/english/

Dr Sieglinde Stähle of the **German food and drinks industries association (BLL)** presented the latest developments of the NanoDialog[3] and NanoKommission. Both multi-stakeholder initiatives were initiated by the federal government and led by the Environment Ministry with the aim of identifying areas where nano can contribute to sustainable innovations, gather information about the risks of nano, support the responsible use of nano and review current regulations. Under the NanoDialog, four Working Groups are addressing the development of a Code of Practice, potential risks and benefits, regulatory issues and risk assessments. The Working Groups are expected to report at the end of 2010.

2. Safety assessment

Industry, policymakers, scientists and risk assessors are working together to overcome the challenges posed by the safety assessment of nano, such as knowledge gaps, analytical and toxicological uncertainties and incompatible data.

2.1 Safety assessment of nanomaterials at the Joint Research Centre

To support policy related to the safety assessment of nano, the **European Commission's Joint Research Centre (JRC)** is developing an assessment methodology, establishing protocols for evaluating nano and providing implementation tools (e.g. the NAPIRAhub information platform and repository of nanomaterials for testing) and data to support safety assessments. **Dr. Hermann Stamm** of the **Institute for Health and Consumer Protection** of the JRC, stated that defining nanomaterials for regulatory purposes is of key importance and requires a single definition that is broadly applicable in EU legislation and policies. The definition must be clear and unambiguous to be enforceable and must be in line with other approaches worldwide. The JRC is coordinating its work on nano with the other Directorates-General of the European Commission, the Organisation for Economic Cooperation and Development (OECD) Working Party for Manufactured Nanomaterials, Member States, standardisation committees (ISO, CEN), the EFSA Working Group on Nanotechnology and the European Chemicals Agency (ECHA). The JRC's key questions concerning the definition of nanomaterial are: what is a "material" in the context of "nanomaterial"? What is the nanoscale and which size range should it encompass? Should other properties which are the consequence of the material being at the nanoscale be included? The JRC will publish a report in the next few months addressing the scientific aspects of these questions. The JRC is also conducting in vitro tests of nanomaterials to understand the biological response, characterisation, toxicological profile and dose-effect relationship.

2.2 Update on the International Life Sciences Institute Activity on Safety Assessment of Nanomaterials in Foods.

The **International Life Sciences Institute (ILSI)** defines engineered nanomaterials as materials which have been purposefully engineered at the nanoscale to produce new properties. To help industry overcome analytical and toxicological uncertainties when assessing the safety of engineered nanomaterials in foods, ILSI has convened an Expert Group composed toxicologists, technologists and risk assessors from industry, academia and scientific organisations such as EFSA. The aim of the group is to develop a Guidance document on the safety assessment on potential direct applications of engineered nanomaterials in foods with respect to consumer safety. **Dr. Anne Constable** presented the Expert Group's progress to date. The Guidance document aims to: identify unique characteristics which might require specialised assessment methodologies; develop a decision-tree

[3] http://www.bundesumweltministerium.de/gesundheit_und_umwelt/nanaotechnologie/nanodialog/doc/37262.php

to classify and prioritise food-related nanomaterials; establish data requirements for risk assessment; and provide a systematic, structured framework using time-served approaches. Currently, the Expert Group considers that a conventional risk assessment is appropriate for engineered nanomaterials, although a case-by-case approach is needed, as each nanomaterial is different. The decision tree can help prioritise the materials to be tested. The physical-chemical properties of the materials should be well characterised Free, non-biodegradable persistent particles are considered to be the materials of highest concern. A tiered approach to testing is being considered, with a screening step targeting toxicological hot spots. Harzard analysis could be supported by the OECD Testing Protocols. Comparators, such as the raw (or bulk) materials should be used when possible at each step and as controls in testing procedures and in the risk assessment process. The Expert Group held its first meeting in February 2009 and will produce a manuscript in October 2010. A workshop will be held in spring 2011, following which the final manuscript will be submitted to a scientific journal.**2.3 Latest developments of EFSA's nano assessment**

Risk assessors face complications when it comes to establishing the safety of nano because of information gaps, the lack of scientific publications designed to answer risk assessment questions and the lack of guidance documents, stated **Dr. David Carlander, Scientific Officer at EFSA**, citing EFSA's 2009 opinion on "The Potential Risks Arising from Nanoscience and Nanotechnologies on Food and Feed Safety". There is a need to characterise the extent of these uncertainties and to communicate about the uncertainties as well as the strengths of assessments. To reduce some of the uncertainties and to facilitate the provision of sufficient data, the Commission has asked EFSA to give an opinion on guidance for the risk assessment "of engineered nanomaterials" (which EFSA understands to be the same as "manufactured nanomaterials") "and other nanotechnologies" in food additives, enzymes, flavourings, food contact materials, novel foods, food supplements, feed additives and pesticides. EFSA's previous opinion in 2009 stated that the risk assessment of engineered nanomaterials has to be performed on a case-by-case basis, based on the proper identification and comprehensive characterisation of the engineered nanomaterial as used in food or feed and on exposure data. EFSA's new opinion will provide practical recommendations for the risk assessment of food-related nano applications. Where uncertainties exist, EFSA has been asked to indicate the endpoints and/or parameters that would have to be known to carry out a risk assessment. EFSA has already held many consultations on the opinion and a first draft is expected in July 2010. EFSA is also collaborating with the European Commission, Member States, international fora, academia and other stakeholders.

3. Filling the knowledge gaps

The safety of nano is of utmost importance; thus, the public and private sectors have made considerable investments in researching and testing the safety of nano.

3.1 Safe nanotechnology: EU industrial research

Georgios Katalagarianakis, European Commission Directorate-General (DG) Research, presented the conclusions of the second implementation report (2007-2009) of the Commission's First Nanotechnology Action Plan 2005-2009. The report finds that progress has been achieved in most areas. The report places a heavy emphasis on safety and recommends that more research is needed on safety assessments throughout the product life-cycle, that the adequacy of regulation and international developments should be reviewed and that the market should be surveyed for products using nano.

In order to leverage European investment in nano R&D and innovation, there is a perceived need for a European nano strategy to support the timely development of a broad portfolio of targeted nanotechnologies in combination with responsible and supportive governance. The Commission is evaluating three policy options: 1) no action plan with a regulatory review and inventory of

nanomaterials by 2011, 2) an action plan with an emphasis on coherence between EU and national policies and coordination in key areas for innovation and 3) a new structure for innovation with a mandate to develop and implement innovation policy in order to coordinate with Member States and industry. All three options are still on the table. The objectives would be to support innovation and the application of nano and to strengthen an integrated, safe and responsible approach to the use of nano.

DG Research has allocated €82 million to nano research and risk analysis (see Annex 1). The NanoLyse project will focus on food and will start in April 2010 (see Annex 1 for 2010 and 2011 proposals).

DG Research is supporting many policy bodies to promote the coordination of research on nano. These bodies include the High Level Experts Group of Member States, Nanosafety Cluster and Industrial Group on Safety, all of which were established in 2009. The NANOFUTURES technology platform will be launched in June 2010 and will be an umbrella forum to promote synergy across technology platforms. DG Research strives for global coordination through the OECD and through Science and Technology Agreements with countries that are researching and testing the safety of nano. Discussion points for next steps are how to manage industrial safety in the nano-industry and how best to combine efforts.

3.2 Unilever's approach to ensuring the safety of novel nanomaterials – supporting risk assessment science

Unilever's Code of Business Principles & Policies defines commitments to consumer, occupational and environmental safety and sustainability and to high ethical standards for human testing and the elimination of animal testing. The Chief Executive Officer is responsible for overseeing these commitments with the support of the **Safety and Environmental Assurance Centre (SEAC)**. SEAC's mandate is to provide independent scientific evidence and guidance so that Unilever can identify and manage risks for consumers, workers and the environment and environmental impacts. Unilever believes there is considerable potential for new benefits through the application of specific nanotechnologies. However, the decision to apply any new technology in Unilever's products will always be taken on the basis of comprehensive safety and environmental evaluations, substantiation of benefits, regulatory compliance and consideration of consumer acceptance. To close safety and environmental assessment data gaps, Unilever is conducting internal research and sponsoring external research. **Bobby Bradford**, SEAC, presented Unilever's Risk Assessment Framework, which supports Unilever's position by assessing the risks to consumer, occupational and environmental safety. Unilever's Risk Assessment Framework will be adapted to integrate new guidance from regulators as appropriate. Inhalation toxicology is a key area of research, with many studies using in vitro techniques to reduce the use of animal studies. Once the hazard and exposure have been determined, SEAC delivers its opinion. If a risk assessment finds an unacceptable level of risk, SEAC delivers a negative opinion or recommends protection measures in the case of occupational hazards. If a risk is detected in a product that is already on the market, SEAC recommends the product's removal from the market.

4. Applications of Nano in the Food Chain

4.1 Advancing plastic's potential

When polyethylene terephthalate (PET) plastic is repeatedly recycled to make new containers for food and non-food products, the material naturally yellows. **Dr. Ian Appleyard** from **ColorMatrix** explained that when a nano powder material made from titanium nitride, so-called "Joule RHB", is added to the PET plastic, the plastic exhibits less of this yellowing effect: the natural blue toning property of Joule RHB results in PET containers that are clearer and brighter after repeatedly being recycled. The nanomaterial also offers environmental advantages, such as optimising heat uptake

performance during PET manufacture, which results in energy savings and reduced carbon emissions. It also allows bottle blowing lines to run more consistently, which results in less waste. Furthermore, the nanomaterial facilitates higher percentages of recycled PET usage in packaging applications because it optimises bottle aesthetics over the long-term.

Joule RHB was approved for use in PET by the U.S. authorities in 2008[4] and by the German authorities in 2009[5]. EFSA's scientific opinion of November 2008 found that Joule RHB is completely insoluble in food and that no migration was demonstrated; thus there are no toxicological concerns and no exposure through food. Joule RHB was listed in the closed EU provisional list of food contact additives in 2009, and is thus legal to use in Europe as per Regulation 1935/2004 on materials intended to come into contact with food. Joule RHB is commercially available and is used worldwide, including in Europe.

4.2 Anti-caking agents

Food products are often made with ingredients in the form of powders. Anti-caking agents help powder ingredients mix evenly and prevent clumping. Synthetic amorphous silica (hereon "silica") is one such anti-caking agent. Solid forms of silica are nano-structured materials, but during conventional processing they form bulk materials which are larger than 100 nano-meters, **Dr. Monika Maier** from **Evonik Industries** explained. Silica has been approved for use in the EU and the oldest types of this anti-caking agent have been on the market for 50 years. Numerous safety tests of silica consumption have shown no signs of toxicity or mortality. However, depending on the definition of nanomaterial, a new risk assessment from EFSA may be required under EU food additive legislation. This necessity largely depends on how nano particles as a bulk material are defined, because the nano particle of silica is not used in food applications but the bulk material, which exceeds 100 nanometres, is used. In this respect, Dr. Maier stated that the definition of nano should also clarify what is considered an existing material and what is understood as a newly developed material. It was suggested that there is a potential need for regulators to have more information about new developments and to clarify the additives legislation in light of such considerations.

5. Potential applications in the food chain

5.1 Food contact and food-related sensory materials

So-called "smart colours" or "smart pigments", which are created by structural changes at the nano-level to produce colours that change depending on the angle or on exposure to humidity, are used in many applications, including in diagnostics, logistics and in the semiconductor industry, stated Prof. **Thomas Schalkhammer** from **Attophotonics**. The advantages of smart colours are that the colours are the result of structural changes, not chemicals, and that fewer materials are needed to produce intense colours. Smart pigments, which are designed to have a moisture-sensitive nano-structure, offer a way to indicate humidity changes without using toxic metals or soluble metal salts. The technology could potentially be used for food packaging to indicate spoilage and microbial contamination. Another potential use for smart colours is in writing on the inside of a sealed package with a laser, which could serve as an anti-counterfeiting measure. At present, the lack of capacity for large-scale production makes it economically challenging for a wide application. Participants stated that if the technology was to be used at the current cost, it would have to be justified by the benefits it brings to consumers.

5.2 A case study of active silver and antimicrobial coatings

[4] FCN 818

[5] 17th Regulation amending the Commodities Regulation of 23 September 2009

Nanomaterials could help reduce microbial contamination of poultry meat, a study performed by BioCote and the University of Oxford found. **Dr. Richard Hastings**, Microbiologist at **BioCote**, stated that campylobacter contamination in the food chain costs the UK an estimated €560 million per year[6]. Campylobacter is commonly associated with poultry meat because the bacteria live in the gut of live chickens. Previous research has found that the crates that are used to transport poultry are a likely source of contamination, and various cleaning treatments have been explored.[7] In this study, some crates were treated with antimicrobial active silver. The antimicrobial crates and untreated crates were tested at each stage of the process to compare the levels of campylobacter. The study concluded that active silver had a decontamination effect on the crates and that the antimicrobial efficacy of active silver works as well in practice as it does in the laboratory. The study also confirmed that the crates seem to contribute to the contamination process. Dr. Hastings stated that using active silver would not likely cause increased antimicrobial resistance in campylobacter because active silver is used at lethal levels for the bacteria.

5.3 Nano diagnostics in the food industry

Nano biosensors can serve as an electronic tongue or nose to detect pathogens, stated **Dr. David Sarphie**, CEO of **BIO Nano Consulting**. The nano detection technique was originally developed by University College London for use in the medical field, but could potentially be applied to the food sector. Another technique involving nano rod-based biosensors to detect salmonella has been tested at the University of Georgia. The advantage of using nanomaterials in these cases is that the tools (so-called "micro-cantilevers") are highly sensitive, which makes them useful for detecting pathogens.

6. Consumer attitudes

6.1 Consumer expectations from nano

Consumers should be able to take advantage of nanotechnologies and enjoy the benefits without being put at unnecessary risk, stated **Sue Davies, Chief Policy Adviser, UK consumer association Which?**. Which? understands nanotechnology to mean the deliberate manufacture of nanomaterials to create new properties. Which? is following ISO and EU debates about definitions and supports a compromise that takes into account functionality as well as size.

Consumer awareness of nanotechnologies seems to be growing, but even those who claim to have heard of it are unclear about what it is. Surveys show an increase in respondents who claimed to have heard of nanotechnologies, from 37% in 2007 to 45% in 2008.

To understand consumer views in depth, Which? held a Nano Panel between 29 November and 1 December 2007. 14 panellists, who were broadly representative of the population, heard evidence from a range of expert witnesses on nano in the areas of food, medicines, cosmetics and general consumer products. Consumers were the most positive about potential applications in medicine. For cosmetics, consumers considered that if a cosmetic was on the market it must be safe, though there are also some consumers who are concerned about the level of uncertainty. Nano in food and other consumer products was met with mixed reactions, as some consumers voiced concern while other consumers were more optimistic.

[6] Humphrey et al., 2007. *International Journal of Food Microbiology*. 117:237-573.

[7] Evaluation of the performance of different cleaning treatments in reducing microbial contamination of poultry transport crates. *British Poultry Science*. 2008 ; 49(3):233-40.

Ms Davies stated that there is a lack of transparency about the development of nano food, a criticism that was echoed in the House of Lords' Science and Technology Committee Report on Nanotechnologies in the Food Sector (January 2010). Which? encourages openness, transparency, mandatory reporting and early engagement with consumers. While labelling is an important tool for informing consumers about what is in their food, it needs to be backed up by broader consumer education. Which? considers that nano ingredients should be labelled, and that nano should offer and deliver genuine consumer benefits.

Safety is a priority for Which?. Ms. Davies stated that it is necessary to address research and regulatory gaps, to ensure meaningful and independent risk assessment and to have effective enforcement. The benefits to consumers must also be in line with expectations. Claims that are made about the benefits must be trustworthy. She stated that nano is very different to genetic modification (GM) but that the debate is being played out in a similar fashion, in terms of the lack of transparency and public suspicion. Ms. Davies recommends that uncertainties should be made clear, as well as what is being done to address such uncertainties.

6.2 Consumer attitudes towards nano

A review of the literature on consumer attitudes toward new food technologies shows that consumer understanding is generally low and wariness is high. A closer look at the results shows that consumer attitudes differ depending on the technology: e.g. consumers are more positive towards functional foods, are most concerned about genetic modification (GM), animal cloning and irradiation and are undecided about nano. It is important to note that each study provides a snapshot of a certain point in time and that consumer attitudes may change and evolve, stated **Dr. Josephine Wills,** Director General at the **European Food Information Council (EUFIC)**. She pointed out that past "new" food technologies, such as tinned foods, pasteurised milk and microwave ovens, have gained acceptance over a long time.

When consumers weigh the risk of a new technology against the benefits, surveys have found that health risks carry more weight than environmental risks, and that benefits must be tangible and direct to outweigh potential risks. Regarding nano, some consumers believe there are health and environmental benefits, while other consumers question the need for nano. Consumers are particularly averse to risks that seem beyond their control; thus the desire to control the risks associated with food consumption translates into demand for clear labelling and safety regulation.

Because most consumers form a view with little or no knowledge about new food technologies, pre-existing knowledge, values and beliefs are the most important drivers of attitudes towards new food technologies. Studies have found that general attitudes are shaped by cultural views, moral and ethical considerations, opinions about science and technology and the impact on social and economic equity, health and nutrition and the environment. The reliance on pre-existing knowledge, values and beliefs means that certain words have negative connotations (e.g. cloning, irradiation), that negative information carries more weight than positive information and that consumer biases weigh heavily in the assimilation of new information.

Consumers' views and intentions may not always impact food purchases. While surveys have found that consumers with a negative opinion on new food technologies claim to be willing to pay a premium to avoid the technology, price, taste and convenience often intervene when consumers make actual purchasing decisions.

Research has found that the media play an important role in shaping public attitudes, although the media are more trusted in some countries than in others. Trust in the information source can be more important than the accuracy of the information. A 2006 Eurobarometer survey found that health professionals, university scientists and consumer organisations are more trustworthy than industry scientists and the media.

EUFIC's media analysis shows that nano has been the second-most cited new food technology over the last five years, after GM, but GM remains the focus of the vast majority of articles. Of all the articles on nano over the last five years, 10% of the articles mention nano in relation to food. Between 2005 and 2009, the UK produced nearly nine times more articles on nano in relation to food than Germany, Spain and France individually.

There is no single "public" view on nano because different population groups hold different views, stated Dr. Wills. Consumers in the U.S., Asia and developing countries tend to perceive greater benefits from nano than in Europe. However, European consumer awareness of and support for nano is increasing, as the percentage of respondents who think nano will have a positive impact in the future has grown from 29% in 2002 to 48% in 2005. Research has found that women are likely to perceive fewer benefits from nano than men, but they also have a higher rate of "don't know" responses. Higher levels of awareness and support for nano are associated with higher socio-economic grades and more education, but this correlation disappears when multivariate analysis is conducted and values and beliefs are included. Young people tend to be more positive about new food technologies, while older people are likely to have more concerns, with the exception of nano in packaging.

Conclusion

Following a lively debate on the topics discussed during the day, **Dr. Mike Knowles of CIAA, Chairman of the Nano Dialogue,** drew the following main conclusions:

- There is a continued need for openness, transparency and consumer engagement in the development of nano, though there may be limits to the availability of specific information due to confidential business information, intellectual property rights or other legal restrictions.
- The EU plays a key role both in furthering innovation and commercial development in this field and in setting a common regulatory framework that gives the required safety assurances to consumers and stakeholders. Stakeholder dialogue is key to informing the current development of the EU regulatory framework, which also needs to be aligned with the EU's research agenda.
- The definition of nano should distinguish between the natural occurrence of nanoparticles, their presence through conventional processing techniques and instances where the particle size has been deliberately engineered to behave differently to its conventional counterpart. A workable EU-level definition will be an important step forward.
- Ensuring the safety of products is of utmost importance. Adequate safety assessments on a case-by-case basis are needed where the use of nano gives rise to changes in existing products or processes. The forthcoming EFSA guidance for nano risk assessment will be invaluable to bring the EU risk assessment procedure fully up to date.
- The benefits, uncertainties and actions being taken to address uncertainties about nano should be made clear to consumers.
- In the food sector, potential and actual nano applications may reduce the environmental impact of food packaging and may improve food safety. However, cost to food manufacturers and perceived consumer benefits are central to the uptake of potential applications.
- A better understanding of public attitudes towards nano and other new food technologies is needed, both to determine which applications will be acceptable and to communicate effectively with consumers and other key stakeholders.

- Labelling is one way to communicate about nano, but it is inadequate unless supported by a broader information and education effort.

Annex 1 – EU Nano Research Projects

Sixth Framework Programme

ON SAFETY OF NANOPARTICLES:

- **CELLNANOTOX**: Cellular Interaction and Toxicology with Engineered Nanoparticles
- **DIPNA**: Development of an Integrated Platform for Nanoparticle Analysis to verify their possible toxicity and eco-toxicity
- **NANOINTERACT**: Development of a platform and toolkit for understanding interactions between nanoparticles and the living world
- **NANOSH**: Inflammatory and genotoxic effects of engineered nanomaterials
- **NANOCAP**: Nanotechnology Capacity Building NGOs (FP6-SOCIETY)
- **IMPART**: Improving the understanding of the impact of nanoparticles on human health and the environment
- **PARTICLE-RISK**: Risk Assessment of Exposure to Particles (FP6-NEST)

SAFETY OF PROCESSES

- **NANOSAFE2**: Safe production and use of nanomaterials
- **SAPHIR**: Controlled Production Of High Tech Multifunctional Products And Their Recycling

STANDARDISATION AND METROLOGY:

- **NANO-STRAND**: Standardization related to Research and Development for Nanotechnologies
- **NANOTRANSPORT**: The Behaviour of Aerosols Released to Ambient Air from Nanoparticle Manufacturing - A Pre-normative Study

Seventh Framework Programme

NMP-2007-1.3-1 **Large RTD Projects**	**Specific, easy-to-use portable devices for measurement and analysis** **NANODEVICE**: Novel Concepts, Methods, and Technologies for the Production of Portable, Easy-to-Use Devices for the Measurement and Analysis of Airborne Engineered Nanoparticles in Workplace Air
NMP-2007-1.3-2 **Small RTD projects**	**Risk assessment of engineered nanoparticles on health and the environment** **NANOMMUNE**: Comprehensive assessment of hazardous effects of engineered nanomaterials on the immune system **NANORETOX:** The Reactivity and Toxicity of Engineered Nanoparticles: Risks to the Environment and Human Health **NEURONANO**: Do nanoparticles induce neurodegenerative diseases? Understanding the origin of reactive oxidative species and protein aggregation and mis-folding phenomena in the presence of nanoparticles

NMP-2007-1.3-3 **Coordination**	**Scientific review on the data and studies on the potential impact on health, safety and the environment of engineered nanoparticles** **ENRHES**: Engineered Nanoparticles: Review of Health and Environmental Safety
NMP-2007-1.3-4 **Coordination**	**Creation of a critical and commented database on the health, safety and environmental impact of nanoparticles** **NHECD**
NMP-2007-1.3-5 **Coordination**	**Coordination in studying the environmental, safety and health impact of engineered nanoparticles and nanotechnology based materials and products** **NANOIMPACTNET**: The European Network on the Health and Environmental Impact of Nanomaterials
HEALTH-2007-1.3-4 **Small RTD projects**	**Alternative testing strategies for the assessment of the toxicological profile of nanoparticles used in medical diagnostics** **NANOTEST**: Development of methodology for alternative testing strategies for the assessment of the toxicological profile of nanoparticles used in medical diagnostics
NMP-2008-1.3-1 Large RTD Projects	**Validation, adaptation and/or development of risk assessment methodology for engineered nano-particles** No proposals selected
NMP-2008-1.3-2 Small RTD projects	**Impact of engineered nanoparticles on health and the environment** **ENNSATOX:** Engineered Nanoparticle Impact on Aquatic Environments: Structure, Activity and Toxicology **ENPRA:** Risk Assessment Of Engineered Nanoparticles **HINAMOX:** Health Impact of Engineered Metal and Metal Oxide Nanoparticles **Response, Bioimaging and Distribution at Cellular and Body Level** **INLIVETOX:** Intestinal, Liver and Endothelial Nanoparticle Toxicity Development and evaluation of a novel tool for high-throughput data generation **NEPHH:** Nanomaterials Related Environmental Pollution And Health **Hazards Throughout Their Life Cycle**
NMP-2008-1.3-1 Small RTD projects	**Activities towards the development of appropriate solutions for the use, recycling and/or final treatment of nanotechnology-based products** **(Joint call with Theme 6: 'Environment - Climate Change')** **Four proposals selected for negotiation:** **NANOPOLYTOX:** Toxicological impact of nanomaterials derived from processing, weathering and recycling of polymer nanocomposites used in various industrial applications **NANOHOUSE:** Life Cycle of Nanoparticle-based Products used in House Coating

	NanoFATE: Nanoparticle Fate Assessment and Toxicity in the Environment **NanoSustain:** Development of sustainable solutions for nanotechnology-based products based on hazard characterization and LCA
NMP-2008-1.3-2 Coordination	**Exposure scenarios to nanoparticles** **NANEX:** Development of Exposure Scenarios, for Manufactured Nanomaterials
KBBE-2009-2-4-1 Small RTD projects	**Analytical tools for characterisation of nano-particles in the food Matrix NanoLyse:** Nanoparticles in food: analytical methods for detection and characterisation

2010 calls closed

- Infrastructure integration (proposal submitted)
- Modelling/simulation (NMP call closed, jointly with USA)
- Risk management (NMP call closed)
- ERANET (proposal submitted)

2011 call topics

- New methods and strategies for measurement, detection and identification of nanoparticles in products and/or in the environment (SME targeted)
- Worker protection and exposure risk management strategies for nanomaterial production, use and disposal (small)
- Intelligent testing strategies for nanomaterials impact and exposure – towards regulation and clustering of materials (CSA)

Annex II - **UK Environmental, Health and Safety Research**

- To help address some of the research gaps concerning nanoparticles following consumption in food, the UK Food Standards Agency (FSA) has commissioned two projects which commenced in early 2010 to investigate the behaviour and fate of nanoparticles in the gut.
- FSA is also jointly funding a three-year project entitled *Nanoparticles in Food: Analytical Methods for Detection and Characterisation*, which commenced in January 2010.