Dialogforum Nano of BASF
2011 | 2012

Transparency in communication on nanomaterials from the manufacturer to the consumer
Dialogforum Nano of BASF Members

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Expertise, Discussions and Positions

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Dr. Volkmar von Arnim, Institute of Textile Technology and Process Engineering (ITV) Denkendorf

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Dr. Edith Claßen, Hohenstein Institute

3.5.3 Nanomaterials in textile printing
Dr. Rolf Wittlinger, BASF SE

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Beate Mangold, Tchibo GmbH

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Christina Meßner, Textile+Fashion Confederation

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Dr. Peter Bachhausen, BASF Coatings GmbH

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Dr. Dietmar Eichstädt, German Paint and Printing Ink Association

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Dr. Helge Kramberger, Dr. Robert-Murjahn-Institut GmbH

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What do consumers want to know about nanoproducts? How should manufacturers and retailers communicate? In this context, which definition should the companies refer to and how do companies and civil society groups deal with topics such as mandatory labeling and product registers?

In the Dialogforum Nano of BASF 2011/2012 representatives of research organizations, trade unions, retailers, industry, churches as well as environmental and consumer organizations developed concrete approaches toward achieving more transparency in communication on nanomaterials from the manufacturer to the consumer.

To achieve this, consumer inquiries to companies and consumer organizations were analyzed. In expert hearings the group discussed which scientific information is available and how the safety of nanomaterials can be tested, where knowledge gaps exist and how information can be appropriately prepared for consumers. As a result, recommendations for the organization-internal structuring of information and for consumer communication were developed. Dirt-repellent and antimicrobial textiles as well as paints and varnishes were treated in an exemplary manner.

The essence of the recommendations is seven questions for the supply chain, for building up reliable information in companies:

1. Information on the nanomaterial used: How can the material be characterized?
2. Does the EU definition recommendation for nanomaterials apply to the material in question?
3. A) How can the effect and the new functionality generated through the nanomaterial be explained? B) How can the effect and the new functionality be explained if the material in question is not a nanomaterial?
4. How can the added value of the nanomaterial be described compared to other products?
5. How is the risk assessment of the used material carried out? With what results?
6. How is the material / product in question to be recycled / disposed of / handled at the end-of-pipe?
7. Where can further information be found?
The Dialogforum Nano recommends a three-level information structure for communication with consumers:

- Provision of general information on nanomaterials and nanotechnologies
- Understandable communication of specific product information
- Additional information and links

Moreover, the group made suggestions on the form and contents of the consumer communication and supplemented specific recommendations on the selected application examples: textiles, paints and varnishes.

In the Dialogforum Nano, representatives of very different interest groups have successfully worked out common recommendations for the practice; the latter are transferable and can provide worthwhile support in the sense of good consumer information. The present report therefore is equally oriented toward companies, associations and civil society organizations. It also shows that this type of results-oriented dialog supports the development of knowledge for all those participating and that the format could be interesting for decision makers in other industrial sectors as well.

Thanks to their personal commitment, all those participating have contributed to an innovative dialog process in which the joint work on the recommendations, the productive dealing with dissent and the development of mutual appreciation were at the focus. For this reason, a continuation of the Dialogforum Nano of BASF is desired by all participants.
1 Background

1.1 Context of the Dialogforum Nano

The starting point of the Dialogforum Nano was the question, how to deal with rapid technological developments, which generate uncertainty through their complexity and the ambiguity of expert opinions. “Areas of no knowledge” are typical characteristics which accompany such innovation processes.

The dialog on nanomaterials is a good example for the societal challenges related to innovations. The possible benefits, the potential risks to people and to the environment as well as the meaningfulness of products have all to be assessed. How should this assessment be carried out considering the enormous variation and possibilities of nanomaterials in the different fields of application?

The rapid development of scientific knowledge concurrently requires more frequent adaptations at the regulatory level. This impedes a clear orientation for all participating stakeholders. In this context, political decision makers have the responsibility of considering and balancing the various moral values, expectations and interests. Against this background, one of the key challenges is: how to improve the information structures and transparent communication on nanomaterials over their product life cycle?

The participants of the Dialogforum Nano of BASF have faced these societal challenges and tested new ways in which representatives of different interest groups systematically reviewed different assessment perspectives and jointly developed practice-oriented recommendations.

“The timing of this information is unbelievably opportune. The life cycle approach on communication pathways to stakeholders with specific tools is what we need in making progress. (…)”


Recommendations for manufacturers and civil society actors

In the first working phase in 2009/2010, the manufacturers of nanomaterials were at the focus of the recommendations. Suggestions were compiled for safety data sheets, technical specifications, customer discussions and training sessions, for setting up internal databases, Internet information, sustainability reports and hotlines. Additionally, recommendations for information instruments of the civil society actors were developed. These include Internet websites and print media, individual inquiries as well as information for employees or members.

With these recommendations for manufacturers and civil society organizations the Dialogforum Nano laid important foundations for more information and transparency across the product life cycle of nanomaterials. However, it also became clear that good consumer communication can only then be achieved when the downstream chain — i.e. applying companies, suppliers, manufacturers of consumer products and retailers — also provide target group-oriented, reviewed information. The group was therefore expanded in 2011/2012.
Recommendations for suppliers, original equipment manufacturers and retailers

For the Dialogforum Nano 2011/2012, with regard to its selected thematic focus textiles, a large retail company, at the same time manufacturer of its own brand, joined in. Suppliers of the textile industry were consulted and the Confederation of the German Textile and Fashion Industry took part in the dialog. For the second focal area, paints and varnishes, the group conducted discussions with suppliers and original equipment manufacturers as well as with the German Paint and Printing Ink Association. A representative of the European Research Group on Environment and Health in the Transport Sector (EUGT) took also part. Scientific experts were invited for both subject areas and the group discussed the fundamentals and limits of knowledge with them in order to be able to form realistic assessments.

The key question of the Dialogforum Nano of BASF remained the same for both dialog series:

Who should be provided with what kind of information, by what means, from whom, for what purpose and when?

“The responsible use of nanomaterials in consumer-related products such as textiles or paints and varnishes requires a timely examination of the opportunities and risks of the respective application. Questions pertaining to the exact functionality of the nanoproducts and their possible additional benefits are just as important as the risk aspects during their utilization or their disposal. This integrated examination must include the entire product life cycle and requires a high level of transparency in communication. Against this background, the Dialogforum Nano has worked out extremely helpful recommendations for important application areas and different actors. I hope that these recommendations will receive as much attention as possible in every-day practice.”

Martin Möller, Oeko-Institut e.V. (Institute for Applied Ecology)
1.2 Consumer inquiries about nanotechnologies

Retailers, original equipment manufacturers and consumer organizations face the challenge of answering increasingly critical consumer inquiries on nanomaterials appropriately, with regard to both form and contents. Inquiries from the media are increasing as well. In the first Dialogforum 2011/2012 workshops different types of consumer inquiries were identified in order to determine the information which the companies must prepare to answer these questions. The following characteristics of consumer interest were discussed:

General focuses of consumer interest

- It is generally important to the consumers that no hazards emanate from the products.
- At present the consumers’ focus of interest is on personal health.
- Questions about the effects on the environment are increasing.
- All in all, information on the impact of nanomaterials in products in close proximity to the body, such as textiles, is more frequently asked for than information on paints and varnishes or on applications in the automotive sector.
- In many consumers and journalists’ inquiries information on testing authorities and on their trustworthiness is desired.
- Inquiries about labeling or about the possibility of identifying nanoproducts are frequent.
- Consumers are looking for advice because they cannot sort out the information available.

Consumer inquiries in the textile sector

- The number of critical questions on antimicrobial textiles (socks, sport jackets, mattress pads, duvets) and on the use of nanomaterials is increasing independent of whether the active effect has been achieved with nanomaterials.
- The number of questions related to the warning given by the German Federal Institute for Risk Assessment (BfR) about nanosilver particles is increasing: Statements from the relevant companies are desired in this context.
- Information on following issues is requested: the coatings of dirt-repellent textiles, their chemical-physical treatment, their properties, the function and durability of their properties, instructions for their care and on how to dispose of the products.

“The Dialogforum Nano is an innovative and successful approach of stakeholder communication, decisively influenced by the particular commitment and the willingness of the participants from extremely varied sectors of the business sector and society to engage in dialog and discussion. It has been possible to work out a large number of recommendations, which will hopefully be adopted in practice and thus make a contribution to the improvement of transparency and communication over the product life cycle of nanomaterials.”

Dr. Rolf Buschmann, Consumer Association of North Rhine-Westphalia
Consumer inquiries in the paint and varnish sector

- Consumers desire information on the durability and quality of the products.
- Inquiries on their use in the do-it-yourself sector are also being received.
- Additional information on the environmental compatibility of facade paints is also desired.

Results of the discussion on the consumer inquiries

- The group shares the observation that consumers are increasingly uncertain. In some cases the term “nano” is used in advertising, whereas other companies avoid mentioning the word “nano” at all. Both communication strategies are employed whether or not nanomaterials are actually used. The majority of the group believes that harmonization is urgently required.
- Various general information sources on nanomaterials in textiles, paints and varnishes are available on the Internet for consumers and professional users (see Appendix III). These could also be used by manufacturers for consumer communication.

- Easily understood product-related information is seldom accessible to the consumer at the present time. Consequently, the dialog group considers direct communication from the product manufacturers or from retailers to the consumer or to the professional user to be strongly in need of improvement.

“The Environmental Representative of the Diocese of Speyer represents the Catholic Church in the Dialogforum and had the possibility to state his position. Participation in such dialogs is a precondition for religious work. The judgment and attestation of the church is called for when decisions and questions regarding human life are under consideration. However, in the opinion of the Environmental Representative, such questions have not yet been at the focus of the Dialogforum Nano.

Therefore, the Church’s contribution could remain hypothetical and in mutual agreement: the Church will consider the benefits and hazards in accordance with its own standards at the appropriate time and present these standards to industry and politics. To the extent that the Church, as a participant in the economic process, should itself use and benefit from nanotechnology, its own standards would then obviously also apply to itself as well.”

Dr. iur. utr. Frank Hennecke, Diocese of Speyer
On the basis of the discussion on the consumer inquiries, the participants decided to develop recommendations for structured compilation of organization-internal information in the form of a guideline. The recommendations are oriented toward suppliers, original equipment manufacturers, and retailers, whose products are manufactured with nanomaterials. In addition, recommendations were made available for the communication on materials that are not nanomaterials themselves, but which have been brought into connection with nanotechnology by the consumer. These include active effects, such as dirt- and water-repellent properties, antimicrobial properties, scratch resistance or UV resistance, which are frequently perceived as “nano effects”.

In the following sections, suggestions for internal research and application-specific questionnaires with seven core questions each have been compiled on textiles as well as on paints and varnishes. Retailers or original equipment manufacturers can send these to their respective suppliers, in order to compile the information that is required for good consumer communication. The recommendations thus refer to the communication between experts (business-to-business) of different companies in the supply chain.

The questionnaires are based on the following principle, which is shown in the flow diagram (Fig. 1).
Recommendations for information structure

1. Information on the nanomaterial used: How can the material be characterized?

2. Does the EU definition recommendation for nanomaterials apply to the material in question?

3. A) How can the effect and the new functionality generated through the nanomaterial be explained?

3. B) How can the effect and the new functionality be explained if the material in question is not a nanomaterial?

4. How can the added value of the nanomaterial be described compared to other products?

5. How is the risk assessment of the used material carried out? With what results?

6. How is the material/product in question to be recycled/disposed of/handled at the end-of-pipe?

7. Where can further information be found?

Fig. 1. Flow diagram on structured information across the product life cycle.
2.1.1 Basic information elements

- Identification of suppliers / contractors and, if applicable, their upstream supply chain
  - Check of willingness and possibilities to answer the questionnaire

- Survey of which information has to be compiled from other sources
  - e.g. from scientific studies, independent institutions, public agencies or product databases

- Screening of currently discussed benefits and risks in the public debate on nanotechnologies
  - e.g. via media analyses, environment and actor analyses
2.1.2 Seven questions for the supply chain in the textile sector

<table>
<thead>
<tr>
<th>1.</th>
<th><strong>Information on the nanomaterial used: How can the material be characterized?</strong></th>
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<tbody>
<tr>
<td></td>
<td>If possible, the chemical-physical specification of the substance, information on particle size (particle size distribution / fraction in %), morphology, incorporation (e.g. bound in a matrix), consideration of the coating of the particles</td>
</tr>
<tr>
<td></td>
<td>Available relevant scientific studies on this subject</td>
</tr>
<tr>
<td></td>
<td>Consideration of the possible changes that the material undergoes in the course of its product life cycle</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.</th>
<th><strong>Does the EU definition recommendation for nanomaterials apply to the material in question?</strong></th>
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<tbody>
<tr>
<td></td>
<td>Explanation of how this was determined</td>
</tr>
<tr>
<td></td>
<td>Possible additional reference to other definitions</td>
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<thead>
<tr>
<th>3.</th>
<th><strong>A) How can the effect and the new functionality generated through the nanomaterial be explained?</strong></th>
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<tbody>
<tr>
<td></td>
<td>Diagrams, information graphics, descriptions, possibly information on technical processes</td>
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<th>3.</th>
<th><strong>B) How can the effect and the new functionality be explained if the material in question is not a nanomaterial?</strong></th>
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<tbody>
<tr>
<td></td>
<td>Diagrams, information graphics, descriptions, possibly information on technical processes</td>
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<th>4.</th>
<th><strong>How can the added value of the nanomaterial be described compared to other products?</strong></th>
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<tbody>
<tr>
<td></td>
<td>For example: UV protection, antimicrobial action, durability of textiles</td>
</tr>
<tr>
<td></td>
<td>Specific benefit of the nanomaterial should be presented</td>
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<th>5.</th>
<th><strong>How is the risk assessment of the used material carried out? With what results?</strong></th>
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<tbody>
<tr>
<td></td>
<td>Exposure to the nanomaterial Yes/No for consumers under normal conditions of use (abrasion, leaching, vaporization, oral contact)</td>
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<tr>
<td></td>
<td>Existing safety studies on the interaction with the human body or with the environment</td>
</tr>
<tr>
<td></td>
<td>Note: if no completed risk assessment exists for a given nanomaterial, the group recommends a preliminary risk assessment (see links in Appendix II)</td>
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<th>6.</th>
<th><strong>How is the material / product in question to be recycled / disposed of / handled at the end-of-pipe?</strong></th>
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<tr>
<td></td>
<td>Focus on new materials</td>
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<td></td>
<td>Consideration of different handling regulations under European waste legislation</td>
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<th>7.</th>
<th><strong>Where can further information be found?</strong></th>
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<tbody>
<tr>
<td></td>
<td>Studies from scientific institutions, possibly quality labels or certificates</td>
</tr>
<tr>
<td></td>
<td>Possible further measures for safety and quality of the products</td>
</tr>
<tr>
<td></td>
<td>Note: The Appendix includes links and information on actors, research projects and quality tests performed at various institutions for the textile sector</td>
</tr>
</tbody>
</table>
**Specification of questions for textiles with antimicrobial properties**

**Addendum to 1: Specific information on the material used to produce the antimicrobial function**

- Additional description of the effect – e.g. high or low antimicrobial activity – as required, information on tests for efficacy, durability, practical utility for the consumer (e.g. odor-inhibiting, improved hygiene)
- Information on the substance groups and materials in question: zinc compounds, silver salts, organic compounds, etc.
- Information on whether a coating (of the particles) influences the biocidal effect

**Supplementary question: Is the active substance for this antimicrobial application approved as a biocide?**

- Reference to the EU Biocidal Products Directive and to the approval requirement for the biocidal active substance as well as to the labeling requirement for textiles treated with the biocide
- Reference to additional relevant actors whom the manufacturer/outfitter uses for orientation (see links in Appendix II)

**Addendum to 4: Added value of the antibacterial nanomaterial compared to other products**

- Discussed value arguments: Sustainability (life cycle, resource efficiency), individual or social added value (comfort, manageability, esthetics, odor-reduction) as well as economic advantages (price)

**Addendum to 5: Links to further information**

- Presentation of recognized, scientifically oriented organizations which have assessed the quality of the antibacterial effect (efficacy and duration) and the risks. Presentation of dialog activities
- Reference to recognized labels (differentiation between company labels vs. those of recognized, independent institutions)
### Specification of questions for textiles with dirt- and water-repellent properties

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<tr>
<th>Addendum to 1: Specific information on the material used to produce dirt- and water-repellent surfaces</th>
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<tbody>
<tr>
<td>Additional information on the incorporation (bound in a matrix / application with bonding agents / application without bonding agents) and on the form in which the nanomaterials or nanostructured materials (particles, aggregates, agglomerates) are contained</td>
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<thead>
<tr>
<th>Addendum to 3. A): Explanation of the effect and of the new functionality generated through the nanomaterial</th>
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<tbody>
<tr>
<td>Reference to processes with which dirt- and water-repellent effects can be generated through nanomaterials:</td>
</tr>
<tr>
<td>Direct structuring of the fibers; no particles are released</td>
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<tr>
<td>Introduction of a nanomaterial into the fiber to generate the effect</td>
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<th>Addendum to 3. B): Explanation of the effect and of the new functionality if the material in question is not a nanomaterial</th>
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<tbody>
<tr>
<td>The desired effects can be achieved with chemical treatment without nanoparticles (fiber coating, e.g. with fluorocarbon resin, waxes, paraffins)</td>
</tr>
<tr>
<td>Specific layers (not nano) can also provide water-repellent effects</td>
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<tr>
<td>A combination with nanomaterials is possible</td>
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<tr>
<td>An augmentation of the functionalization by combining treatments with and without nanomaterials (3. A and 3. B) is also possible</td>
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<tr>
<th>Addendum to 4: Added value of the nanomaterial compared to other products</th>
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<tr>
<td>Reference to generated functionalities — self-cleaning, dirt- and water-repelleince — as well as to possible resource effectiveness (less frequent washing)</td>
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</table>
### 2.1.3 Seven questions for the supply chain in the paint and varnish sector

<table>
<thead>
<tr>
<th>1. Information on the nanomaterial used: How can the material be characterized?</th>
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<tbody>
<tr>
<td>If possible, the chemical-physical specification of the substance, information on particle size (particle size distribution / fraction in %), morphology, incorporation (e.g. bound in a matrix), consideration of the coating of the particles</td>
</tr>
<tr>
<td>Available relevant scientific studies on this subject</td>
</tr>
<tr>
<td>Consideration of the possible changes that the material undergoes in the course of its product life cycle</td>
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<tr>
<td>Note: The relevance of the information on morphology was emphasized in the discussion</td>
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<tr>
<th>2. Does the EU definition recommendation for nanomaterials apply to the material in question?</th>
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<tbody>
<tr>
<td>Usually, the solid materials used in paints and varnishes come under the EU definition recommendation for nanomaterials. However, these solid materials are not free, but rather occur in a binder matrix</td>
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<table>
<thead>
<tr>
<th>3. A) How can the effect and the new functionality generated through the nanomaterial be explained?</th>
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<tr>
<td>Where appropriate, information on the properties and technical processes (e.g. scratch-resistance is generated by adding certain nanomaterials)</td>
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<tr>
<th>B) How can the effect and the new functionality be explained if the material in question is not a nanomaterial?</th>
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<tbody>
<tr>
<td>Where appropriate, information on the properties and technical processes which generate a “nano-effect” (e.g. scratch-resistance can be generated by using silanes (not a nanomaterial) in polymer structures)</td>
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<th>4. How can the added value of the nanomaterial be described compared to other products?</th>
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<tr>
<td>For example: UV protection, antimicrobial action, scratch-resistance, photocatalysis, dirt- and water-repellence, gloss, adhesion, durability of the coating</td>
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<td>Specific benefit of the nanomaterial should be presented</td>
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<tr>
<th>5. How is the risk assessment of the used material carried out? With what results?</th>
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<tr>
<td>Exposure potential for professional users and do-it-yourselfers under normal conditions of use (inhalation, skin contact)</td>
</tr>
<tr>
<td>Exposure potential during the utilization phase of the coated objects (abrasion, leaching, oral contact)</td>
</tr>
<tr>
<td>Existing safety studies on the interaction with the human body or with the environment (toxicity / ecotoxicity)</td>
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<th>6. How is the material / product in question to be recycled / disposed of / handled at the end-of-pipe?</th>
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<tbody>
<tr>
<td>Instruction for disposal of paint and varnish residues</td>
</tr>
<tr>
<td>Information for the disposal of coated objects: Usually, the disposal depends on the type of object</td>
</tr>
<tr>
<td>Consideration of different handling regulations under European waste legislation</td>
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<th>7. Where can further information be found?</th>
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<td>Studies from scientific institutions, possibly quality labels or certificates</td>
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<td>Possible further measures for safety and quality of the products</td>
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<tr>
<td>Note: The Appendix includes links and information on actors, research projects and quality tests performed at various institutions for the paint and varnish sector</td>
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2.2 Recommendations for consumer communication

Different scientific studies on the public awareness of nanotechnologies (see Appendix III) as well as the experiences of civil society groups, of the manufacturers and of retailers were discussed in the Dialogforum Nano of BASF. In the process it became clear that consumers are looking for different levels of information from different sources.

The Dialogforum Nano of BASF therefore recommends a three-level structure for information offerings:

1. General information
2. Specific product information
3. More detailed information and links

This information should be prepared for different media such as the Internet, print media, personal consultations, hotlines, and for answering individual inquiries via email. The same three-level principle can also be used for the information prepared for employees or members, e.g., of consumer organizations.

2.2.1 Three-level information structure

1. Provision of general information on nanomaterials or nanotechnologies
   - What is nano? Size range, reference to definitions, application fields
   - As applicable, information that not all products that offer a "nano-effect", such as dirt- or water-repellent properties, scratch-resistance or antimicrobial properties, are manufactured with the aid of nanomaterials
   - Use of graphics or films for illustration

2. Communication of specific product information in an understandable manner
   - Are nanomaterials used (if so, which ones?) or do other materials generate a "nano-effect"? Functional description of the specific product—if possible, using information graphics and explanatory texts or films
   - Which practical utility / symbolic / societal benefits does the product provide? Which contribution does the use of nanomaterials or nanotechnologies make to this?
   - Do nanomaterials contribute to the sustainability of the product? Can this contribution be quantified?
   - Provision of evidence for the safety aspects for people and environment during application, use and disposal: Which methods and / or experts confirm the safety?

“Nanotechnology opens up a multitude of innovative opportunities in different application areas. In this context, the recommendations of the Dialogforum Nano of BASF represent a valuable contribution to the development of a transparent information system as the basis for the increasing consumer confidence.”

Dr. Birthe Lauer, BASF SE
3. Provision of additional information and links

- Compilation of information pools / “Information Stations” for consumers with in-depth, consumer-oriented studies
- References and links to scientific studies
- References and links to independent test and evaluation authorities / quality labels
- References to processes and stakeholders: Who is responsible for which tests; which authorities monitor which process?
- References to databases or information platforms

2.2.2 Recommendations on contents, form and additional communication measures

General recommendations on content and form

- Testing the accessibility and comprehensibility of the information via practical tests with the relevant target groups.
- Avoiding company-specific terminology, one’s own definitions of nanomaterials or “fantasy labels” which limit the transparency for consumers. Preferably reference to the work on definitions by the European Commission or the International Organization for Standardization (ISO) (see Chapter 3.1).
Advertizing with “nano-free” products is seen as an attempt to profit from the critical discussions or to avoid inquiries.

When providing general information on nanomaterials, comparisons with long-known sources of exposure or with conventional materials (candle soot, milk) should be avoided.

Attempts to relativize the risks of a product by comparing it with the risks of another product (nanomaterials and driving a car) should be avoided, too.

Publications by relevant actors, particularly on risk assessment of nanomaterials should be compiled and commented as required. The transferability of toxicological studies to the specific materials and products should be discussed in this context and proof for the products’ safety presented. In the process, open questions and “areas of no knowledge” should also be addressed.

Labels can be used to convey information.

The retail sector should prepare in-depth information in written form and/or allow their personnel to be appropriately trained by the manufacturer.

Information should be made available at the point of sale.

Various aspects of consumer communication have been specified for textiles as well as for paints and varnishes in an exemplary manner.

**Recommendations specifically for consumer communication on textiles**

- Exact differentiation as to whether nanomaterials or other materials generate the desired effect (e.g. antimicrobial, self-cleaning, dirt-repellent properties).
- Provision of information on the testing processes and safety information (e.g. on abrasion, durability, care, disposal) received from the manufacturer, supplier or outfitter – this applies regardless of whether or not nanomaterials were processed.
- For antimicrobial textiles, the scope and type of applications and their respective appropriateness should be discussed. For example, sportswear and medically required textiles, for allergic people or in hospitals, should be differentiated.

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“My participation on the Dialogforum Nano of BASF was an important experience for me as a participant who is strongly influenced by the natural sciences. Intensive discussions across disciplinary boundaries, technically sound contributions by experts, information on questions that concern consumers, listening to one another, even when one has a different opinion, to better understand the view points of different actors, but also emotional and controversial discussions, finding common positions, questions for which there are no satisfactory answers for all of the actors—all of that together was the Dialogforum Nano of BASF 2011/2012.”

Dr. Armin Lange, BASF SE
Specific recommendations for consumer communication on paints and varnishes

- The classification of pigments in paints and varnishes should be addressed in terms of the definition of nanomaterials
- The possible release, e.g., by abrasion, sanding or weathering should be proved by results of research (see Chapter 3.6, Expertise on paints and varnishes)

Recommendations for additional measures

- Regular evaluation of consumer inquiries and, as required, cooperation with consumer organizations
- Preparation of answers to frequently asked questions (FAQs)
- Formulation of “advisory positions” or application-specific information, which can be used internally or for public communication

Discussion items on the recommendations

There are different opinions within the dialog group as to how a good consumer communication should generally be structured — proactively or individually on request. Representatives from the sectors of the chemical industry, the textile industry, of retail as well as from the paint and varnish sector recommend a proactive approach, whereas the representative of the automotive sector stated that at present only individual inquiries are pertinently answered.

“In the course of my employment in the chemical industry, I have been active in many areas that had direct contact to our customers, but not to the end users. As a result of my participation in this forum, I was confronted with problems and critical remarks which we, as supplier for industrial applications, were often not aware of.

Particularly in the development of new technologies and applications, this type of dialog should be allowed to flow into the project phase so that one must not later discover that everything is technologically perfect, but there is no consumer acceptance and thus that the project has also failed.

Unfortunately, I was confronted with this painful experience on one of my projects. I think that this type of dialog should be mandatory in the development of new technologies and should be component of the phase gate processes in product development.”

Dr. Peter Simmendinger, BASF Schweiz AG
2.3 Assessment and extrapolation of the results

“For the IG BCE the Dialogforum Nano of BASF 2011-2012 was a valuable process, ... because the development of effective methods for appropriate consumer communication is a valuable asset, ... because information on the product life cycle of nanomaterials is absolutely rewarding, ... because it is worthwhile to discuss something with all relevant social stakeholders for a limited period of time, ... because at the end of the Dialog all stakeholders were able to communicate.”

Iris Wolf, IG BCE (Mining, Chemical, Energy Industrial Union)

Result in terms of content
What was jointly achieved? The participants consider the central content-related results of the Dialogforum Nano of BASF 2011/2012 to be the following:

- The compilation of knowledge on the information requirements of consumers
- The compilation of knowledge on the information and communication processes along the product life cycle
- The development of recommendations for the internal organization of information with practice-oriented questionnaires
- The development of recommendations for good consumer communication
- Joint description of criteria for reliable information (see Chapter 3)
- Content-related differentiation of the debates on the questions of definition, labeling and of product registers (see Chapter 3)
- The compilation of scientific expertise on the application fields (see Chapter 3).

These results should now be brought forward.

1. The first step is to transmit the recommendations: Inside one’s own organization, in the sector, in politics, trade unions, environmental and consumer organizations and their umbrella organizations as well as in the different bodies of the churches.

2. The second step is to examine and adapt the respective organization’s own communication strategies and to implement the recommendations (structural and content-related) under inclusion of the supply chain. In this context, an internal, cross-departmental cooperation between the participants and the communication departments of their organizations is required.

3. The third step is the evaluation of cooperation opportunities with organizations that have specific knowledge, e.g., of safety and quality control, of the consumers’ information requirements or of important sources of information.

4. The fourth step should be definite pilot projects, in which the recommendations of the Dialogforum are implemented, accompanied and evaluated.

5. The fifth step is to embed the measures on information structuring in the product and strategy development of one’s own organization. To achieve this, the required information need to be compiled in a structured way for future projects and the issues related to nanomaterials taken up with the suppliers.
“The Dialogforum Nano of BASF is a highly professional body composed of experts which elucidates the complex spectrum of the different areas of tension around the nano issue. In the forum issue-oriented results were worked out in order to be able to better assess the opportunities and risks and to allow comprehensible communication. The elaborated results are helpful for the extension of internal product development and communications measures and are examined for further implementation. We would like to thank the dialog partners for their good cooperation and the intensive exchange of thoughts, in particular the structured moderation and organization.”

Tchibo GmbH

Result in terms of method

Societal dealing with technical innovations requires a dialog procedure that is just as innovative. This applies particularly to the challenge that the resources of civil society actors, science, companies and associations are not equal. From the participants’ point of view the added value of this dialog process is concentrated in the following results:

- Technically competent, intensive discussion with experts from different interest groups with adequate time and space
- Intensive exchange of thoughts in the group regarding actual occurrences, developments or publications during the entire phase of the Dialogforum (see Appendix II)
Search for a common objective, for a procedure and for criteria to deal with new technologies despite gaps in knowledge and uncertainty in the assessment of information

Development of new scopes of action in the interest of proactive consumer communication

 Provision of opportunities for mutual learning about positions, backgrounds, interests, values, communication and information requirements of the different applying branches and stakeholders

Openness of the process and productive handling of dissent

Fair treatment of conflicts and provocations, resilience of the relationships also in events outside of the group. Development of appreciation in the group

Strengthening of one’s own reflection and communication competencies, improvement of communication skills

Transferability of the dialog process to other topics related to technical innovations

In the opinion of the NGO representatives, the economic and social risks should be more intensively considered in the following work phases.

The participants desire a continuation of the Dialogforum Nano of BASF.

"The Dialogforum Nano of BASF is a good example to illustrate that BASF is not only interested in following innovative paths in the development of new products with new technologies, but also in the communication of these technologies. For me as organizer of the Dialogforum, it was fantastic to experience how the working atmosphere in the group has changed over the years, and how the trust between the participants and their mutual appreciation has increased.

We have not avoided critical topics in the Dialogforum and we were able to show that despite conflicting interests it is possible to work together in a results-oriented way as well as to identify and tolerate both consensus and dissent. I was repeatedly surprised at how differently the various stakeholders perceived questions on safety, benefits and transparency. To a large extent, we have achieved the group’s objective of providing impulses of the societal and political discussion on nanotechnology with the Dialogforum Nano of BASF. I hope that the trust that has developed over the years and through the experience will also endure in the future."

Dr. Carolin Kranz, BASF SE
At the beginning of the working phase in March 2011, the Dialogforum Nano of BASF discussed the problematic nature of making specific recommendations for communication against the background of the lack of an internationally accepted definition of nanomaterials. Then, on the 18th of October 2011, the European Commission published a recommendation for the definition of the term "nanomaterial".

Statement on defining nanomaterials
The participants of the Dialogforum Nano initially discussed the problematic nature of the definitions by means of two approaches:

A) ISO framework definition based on physical properties
The International Organization of Standardization (ISO) defines what a nanomaterial is understood to be in terms of standardizations. The graphic on the following page provides an overview of the most important terms.

The term nanotechnologies is defined by ISO as follows: “The application of scientific knowledge to manipulate and control matter in the nanoscale in order to make size- and structure-dependent properties and phenomena, as distinct from those associated with individual atoms or molecules or with bulk materials” (DIN ISO/TS 80004-1).

B) Framework definition of the European Commission based on regulatory needs
The legal framework can be stipulated by the new EU definition recommendation, in order to define what has to be given special attention and, as required, has to be regulated. In the recommendation, a nanomaterial is described as “a natural, incidental or manufactured material containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for 50 % or more of the particles in the number size distribution, one or more external dimensions is in the size range 1 nm-100 nm.” Commission recommendation on the definition of nanomaterial (2011/696/EU).

A threshold for inclusion is necessary because particles of different sizes (in part larger than 100 nm and in part smaller than 100 nm) exist in most materials.

Discussion items
The participants identified different discussion points related to the question of the definition, for which clarification is desired from legislators and associations.

- The central problem in communication on nanomaterials is that the objectives of the definitions are different. As a consequence, nanomaterials are defined differently by ISO than by the EU. This results in great confusion in communication with consumers, the general public and politicians and between companies.

- Dealing with natural nanomaterials (e.g. sand) in a multitude of products has not yet been clarified. On the other hand, without the inclusion of natural materials, relevant applications in the food and cosmetic sectors cannot be covered by regulation.

- The group sees it necessary that the EU definition recommendation should be specified for different application areas by the legislators.

- It is considered problematic that the information on particle number distribution, required for classification under the EU recommendation, is frequently not communicated in the course of further processing.

Figure 2. ISO Classification of different types of materials under the term nanomaterials. Source: BASF.
along the supply chain. In the future, this could be more frequently required and the manufacturers of nanomaterials will have to be prepared for this.

- **Aggregates and agglomerates** should be adequately taken into account.

- **The consideration of the entire product life cycle** is important in order to be able to identify product phases, in which one can speak about nanomaterials in the sense of the definition discussed. In this context, the question is whether a product has to be termed a “nanoproduct” if nanomaterials are only used in early processing phases.

Beyond the question of the existing definitions, the group discussed a **third approach to the term “nano”**, which refers to the perception of products as well as their expected functions and properties.

**C) Expectation of a “nanoproduct”**

Consumers frequently connect specific functions or properties of a product with the expectation that it could be a “nanoproduct”. This occurs independently of whether nanomaterials are actually used or whether other materials generate these properties. A product is then primarily perceived as a “nanoproduct”,

- if specific functionalities (scratch-resistance, self-cleaning, antimicrobial activity, photocatalysis) are expected, which consumers know as “nanoeffects” from the media,

- if the product is assigned a specific benefit (more comfort, less cleaning), conservation of value, health benefits, environmental relief), which is frequently mentioned in the media in connection with nanomaterials,

- if specific risks for health and environment are presumed (ability to penetrate cell barriers, accumulation in the environment, toxic and ecotoxic properties), which are frequently mentioned in the media in connection with nanomaterials.

**Discussion items**

- Manufacturers of consumer products and retailers are confronted with a **public debate** on their “nanoproducts”, which according to definition possibly do not contain any nanomaterials at all (e.g. silver socks).

- Even when no nanomaterials are used, the companies have to deliver appropriate information in terms of good consumer communication, addressing expectations and answering questions. The specific steps for information organization and for communication with consumers, which are listed in Chapter 2, should be implemented.
In the course of the exchange of thoughts on the state of regulation, the issue of labeling was discussed. At present, labeling is not mandatory for products that are manufactured with nanomaterials or nanotechnologies. Mandatory labeling for cosmetic products will however take effect in summer 2013. Then the term (nano) must be written after the applied substance in the information on the components. However, the EU Regulation on cosmetic products (Regulation (EU) No. 1223/2009), refers to a preliminary definition of nanomaterials and does not match with the current EU commission recommendation of 2011. Whether and when an adjustment will be made in this case is currently open (Status March 2013). Beyond this, the EU regulation on the provision of food information to consumers (Regulation (EU) No. 1169/2011) was published on 25 October 2011. This stipulates that as from 2014 consumers must be informed if a food product contains nanoscaled ingredients. With regard to the question of labeling, the group responded as follows:

### Discussion items

- **For paints and varnishes**, the industry’s worry that all painted products as well as printed textiles could become “nanoproducts” based on the EU definition recommendation was discussed. According to the opinion of the group’s majority, this does not bring more information value for consumers.

- **The initiatives for quality tests and quality labels** as a voluntary form of labeling were positively assessed by the group.

- **The civil society actors** emphasized that labels give consumers introductory information as to whether or not this is a nanomaterial at all. In this context, a uniform label would be desirable.

- **The retail sector** should be on request able to provide in-depth information in written form or train their personnel accordingly. In this context, different associations of the sector should cooperate more closely with testing organizations.

- Although the **industry** favored voluntary quality labels, its representatives expressed their concern at comprehensive listing of tests and test results. This could lead to know-how drainage.
3.3 Product register

Subsequent to definition and in close connection with labeling, the question of product registers was discussed. In this context, the group remarked that different objectives and requirements must be considered:

- Information requirements of authorities on components, for the purpose of traceability.
- Information requirements of key communicators in environmental and consumer organizations.
- Information requirements of consumers.
- Interests of companies for the purpose of retaining confidentiality of company knowledge.

The discussions on product registers on European level were not yet completed at the time this report was written. Mandatory registration of nanomaterials is to be introduced as from 2013 in France and Denmark.

Discussion items

- The industries and associations’ representatives support the creation of more transparency for the general public and authorities. However, they commented that non-harmonized, national register forms would not fit in with the ideal of a single European market. A general cross-sector nanoproduct register is not supported: Companies and authorities would face huge bureaucratic efforts, disproportionate to the benefits. The tendency to no longer work with nanomaterials and to no longer use their potential would presumably increase further. Existing sectoral mechanisms, such as the European reporting obligations or industry-wide registers, should be used to create more transparency. Generally, to create more transparency on products that contain nanomaterials, one should start at the substance level. The REACH and CLP databases provide an appropriate framework.

- The consumer organizations ascertained that individual solutions would not contribute to the higher transparency of products or applications in the nanotechnology sector, which many stakeholders consider to be necessary. The objective of a product register is to ensure the traceability of nanomaterials even across different application areas and along the value chain. The consumer organizations therefore consider a coordinated system for recording nanotechnological products at the European level absolutely necessary, due to uncertainties that still exist in the risk assessment of nanomaterials. This is justified both for precautionary reasons, for example for estimating the exposure of humans and of the environment, as well as for the required traceability and regulation of nanomaterials in cases involving identification of potential risks.

- The automotive industry does not see any necessity for a European product register managed by the authorities. For many years, the automotive industry has had a detailed registration system for materials, the IMDS (“International Material Data System”). Using the data deposited in this registration system, material
data sheets are prepared that make it possible to identify the materials used and the proportional substance components for every structural component. The material data sheets also form the basis for subsequent vehicle recycling. Individual structural components can be traced at any time. As information on the use of nanomaterials can be recorded here, an information flow exists over the entire product life cycle.

- From the viewpoint of the environmental organizations, better product information and assessment as well as risk management is required for the protection of humans and the environment. At present, the information structured by the industry does not provide adequate transparency.

Note: To achieve a common recommendation on the question of product registers was not an objective of the Dialogforum Nano. However, the group agrees that if product registers were to be established, the process would have to take place at the European level and with international agreement.
The following question was object of various fundamental discussions in the Dialogforum Nano of BASF: Which criteria must be used in order that the information used for the internal organization of information can be considered reliable?

The Dialogforum Nano recommends a critical classification of information with regard to the following criteria and suggestions and an internal documentation of the classification process. In many situations it is considered to be helpful to communicate e.g. the reliability or quality of the sender or of the factual information also to the general public, because confidence in institutions and processes is a central factor for consumers.

### Reliability of the sender

#### Companies
- Existing ISO 9000, ISO 14000 certifications
- Certification by an independent third party
- Positive supplier ranking
- Confidence in individuals and in the organization, appropriate corporate culture

#### Science
- Scientific reputation of the authors
- Peer Review
- Confirmation of the results by several studies

### Public authorities
- Guidelines, technical rules
- Statements or opinions by public agencies

### Quality of the factual information
- Legally required information (e.g. safety data sheet, REACH Dossier)
- Documents with legal effects (specification agreements, material data sheets, contractually assured characteristics, bilateral agreements, declarations of conformity)
- Generally accessible company / supplier documents with legal obligation
- Use of standardized test procedures
- Certification by an independent third party
- Scientific studies, peer review
- Reference to statements of public agencies, safety assessments, studies
- If applicable, fiduciary reviewed information

### Additional sources of information
- Central, regular evaluation of customer feedback
- Documented experiences
3.5 Expertise in textiles

3.5.1 Nanomaterials in the textile sector: Scientific background

Expert: Dr. Volkmar von Arnim, Institute of Textile Technology and Process Engineering (ITV) Denkendorf

At the focus of the expert presentation were different application examples of nanomaterials for functionalized textiles, such as in the automotive sector, work clothes or for various technical fabrics. Different functionalizations such as UV protection, fire proofing, electrically conductive textiles and antimicrobial properties were addressed. In this context, three principles for implementing nanotechnology into textiles were differentiated:

1. Nanofibers with a diameter of <100 nm, used e.g. in technical filtration;
2. Nanomaterials that are embedded in a fiber matrix, such as TiO2 particles in a polyamide microfiber, which protect against UV radiation and
3. Nanomaterials that are coated onto an existing fiber. Examples for this are superhydrophobic and self-cleaning textiles, which imitate the “lotus effect”.

The ITV Denkendorf confers the Denkendorf Label (Prüfzeichen) as certificate for nanotechnologically manufactured, water-repellent, self-cleaning textiles. Research is carried out with regard to antistatics, hydrophilic, super-hydrophobic and dirt-repellent structures, among others. The question of a possible release of nanoparticles is at the focus in the risk assessment. Whether nanomaterials are released into the air on fracture of nanofibers, on damage to fibers with embedded nanoparticles or to coated fibers is tested under mechanical stress. Tests with nanocomposite-coated polyester fibers showed that in destructive tests only a small fraction (6%) of the released fragments enter the air as nanomaterials. In comparison to this, during the same test, non-treated, washed cotton released a high fraction of dusts (75%) as nanoscaled fragments. The particle release was even higher than in the test of nanocomposite-treated cotton. However, the expert emphasized the lack of clearly defined threshold limit values and of simple testing possibilities for the industry, which impede risk assessment. At the same time he recommended the use of binding agents which hinder nanoparticles from escaping from coatings. Additionally he reported on the project SINaTex, in which a testing method for exposure measurement detecting and characterizing the particles was developed, as well as from the research project TechnoTox, in which exposure measurements, characterization, risk assessment and quality control are combined (see links in Appendix).
Discussion items

- Additional test procedures for testing the release of embedded nanoparticles are required. When nanomaterials agglomerate, the question of possible changes in properties as well of dispersal arises.

- It is of fundamental importance to clarify which exposure is connected with which toxicological potential, and which measures must be implemented until this data is available.

3.5.2 Risk assessment and test methods for nanomaterials in the textile sector

Expert: Dr. Edith Claßen, Hohenstein Institute

As introduction, various quality labels for nanomaterials were presented, among them the Hohenstein Quality Label for Nanotechnology and the Denkendorf Label (Prüfzeichen) for self-cleaning textiles. Additional general nanotechnology certificates test the risk management processes (Cenarios, TÜV Süd / The Innovation Society) or certify the use of nanomaterials (10-9, forumnano). In the Hohenstein Institute, products are tested for biological harmlessness (cytotoxicity, phototoxicity, proinflammation as well as genotoxicity), rub and wash resistance as well as for their “nano-effects” (dirt-repellence, antimicrobial effects or UV protection). Products that pass all of the modules receive the quality label. The fact that the costs for the test procedures are currently rather high was discussed here.

In addition, different research projects were presented: A test method for textiles with nanocomposite treatment developed in the scope of the “Innovation with Norms and Standards” program of the German Federal Ministry of Economics and Technology; an ISO Standard is being prepared in cooperation with the ITV Denkendorf, Sächsisches Textilforschungsinstitut e.V. (Saxon Textile Research Institute) and the TEGEWA Association. In the joint project UMSICHT, the Hohenstein Institute participates on the assessment of the hazards of silver nanomaterials. In this project life cycle assessments are performed on textiles with nanosilver in different application forms and their environmental influences investigated. The objective is to carry out a risk assessment along the entire manufacturing chain from particle and fiber producers up to the textile manufacturers. Furthermore, the “NanoGem” research project of the German Federal Ministry of Education and Research was referred to; here, analyses are conducted for risk assessment of internal and external nanoparticle contacts with organisms.

Discussion items

- The question as to the extent that nanomaterials in or on textiles would have be considered in their disposal was asked. To date there have been only a few studies that have considered this issue. A study by the Swiss Federal Office for the Environment concluded that the quantities of nanosilver in textiles are so low that no additional measures are required for their disposal. According to this, incineration counts as a safe method of disposal. According to the expert’s opinion, this could be considered a recommendation for the manufacturers.

- The environmental organizations consider it to be a deficit that such standard statements are made without representative investigations and that the measurement and testing procedures are not yet technically matured or internationally harmonized. At the same time, the materials are on the market. The tolerable degree of environmental burden cannot be determined at the present time.
The group remarked that exposures are generally to be avoided at the source in the context of precautionary approach.

3.5.3 Nanomaterials in textile printing
Expert: Dr. Rolf Wittlinger, BASF SE

As the third application example, the group discussed pigments for textile printing. The presentation showed that in pigment processing proportions of the used carbon black occur in particle sizes < 100 nanometer (nm). According to the EU definition recommendation of October 2011, carbon black would have to be classified as a nanomaterial. The final pigment preparation together with different ancillary substances is further processed to a pigment paste, which is then printed onto the textile, dried and fixed. Whether, and if so at which time point in the manufacturing process, one would have to speak of a nanomaterial and which consequences this could have, e.g., for a possible product register or for labeling, was discussed. Different BASF SE information tools along the supply chain were described, among them labels on containers, safety data sheets, technical information, certificates and third party confirmations, product specifications, publically accessible information in the Internet, personal consulting or trainings (see also Dialogforum Nano 2009-2011). It was pointed out that BASF, as a manufacturer of pigment preparations and pigment pastes, only advises its downstream customers, but cannot influence the communication by the end product manufacturer of the printed textiles. With reference to the communication of the benefits, the expert’s recommendation was that it is important to stress that carbon black has long been used as a black pigment and that its use produces high color stability.

Discussion items
- The group discussed whether pigments would have to be registered as substances or as mixtures (pigment pastes) under REACH. It is also problematical to assess whether the pigments, the printing paste or the printed textile would have to be listed in a product register as nanomaterials.
- A further comment was directed toward the fact that color printing mixtures that contain nanomaterials would require special consideration in occupational safety in some cases.
- The group discussed the fact that important information on safe handling would have to be communicated along the manufacturing chain.

3.5.4 Product specifications and communication along the supply chain
Expert: Beate Mangold, Tchibo GmbH

At the beginning, standardized and anonymized consumer inquiries were presented: typically customers inquire (by mail, by telephone, or at the point of sale) if the offered textiles contain nanomaterials (nanoparticles) and whether these are firmly attached to the fibers. Tchibo has various textiles with dirt-repellent, odor-inhibiting or antibacterial functions in its product range. To answer the question as to whether these effects are due to the use of nanomaterials, Tchibo draws on its own stipulated product specifica-
tions, on accredited testing institutions, which confirm the product quality, as well as on information obtained directly from the contract partner that manufactured the textiles. Standard answers have been developed for simple, product-specific questions. More critical and more comprehensive questions are forwarded to the company’s internal experts.

Subsequently, Tchibo’s information flow was described—from product development up to distribution in the shops. Already in the product development phase, Tchibo declares specifications for the properties of the materials used. When sample products are received, they are analyzed, the prescribed specifications (e.g. material characteristics) verified and subsequently contractually stipulated. In following phases of product creation further tests are conducted by the company itself as well as by accredited testing institutions. After successful testing, the products are released for sale.

Discussion items

- According to the retailers and consumer organizations, consumers frequently link dirt- and water-repellent textiles automatically with “nanomaterials” and refer to critical reporting in the media.

- In this case, it is recommended to exactly differentiate whether nanomaterials or larger materials generate a “self-cleaning effect”. Furthermore, it is recommended to communicate testing processes and safety information, e.g. on abrasion tests by the manufacturer or outfitter—whether or not a nanomaterial was processed.

- The urgency to offer more differentiated information in other branches as well was also emphasized.

Without good, easily understandable information from the product manufacturers, public acceptance could not be expected. Individual examples of good consumer communication are not sufficient.

3.5.5 Requirements for the communication on nanomaterials in the textile sector

Expert: Christina Meßner, Textile+Fashion Confederation

The German Textile+Fashion Confederation represents about 1,200 companies with approximately 400,000 employees. The use of nanotechnologies provides the textile industry with the opportunity to gain access to new markets by means of new functionalities and at the same time to increase public awareness of the textile industry as an innovative sector. One of the Confederation’s tasks is also to work up information on health and environmental aspects and to be available as a contact for companies and consumers. Nanomaterials are currently being used in the textile industry to implement functions such as self-cleaning, odor-inhibition or UV protection. At the same time, the use of nanomaterials in the textile sector has been criticized, especially since the statements by the German Federal Institute for Risk Assessment (BfR 2009, 2011) on nanosilver applications and the report of the German Federal Environment Agency (UBA 2009) (see links to Textiles in Appendix III). The Confederation thus decided to actively confront the debate and invited representatives of environmental and consumer organizations, research institutes, companies and public authorities to the Round Table “Nanotechnologies and Textiles”. The objective was to discuss both chances and risks and to reach understanding on areas of consensus or dissent. The contents and results remain confidential in the group. The Confederation has published various information materials
in German language (see Appendix III), for example on application areas of nanotechnologies in the textile industry or its statement on nanosilver, which arose at the suggestions of the round table.

Discussion items

- The consumer organizations recommend making this information **available also at the point of sale**.
- Consumer and environmental organizations argued that it is **misleading** if the exposure to new, synthetic materials is compared with sources of exposure which have been familiar to humankind for centuries, such as candle soot (see e.g. Information leaflet of the Textile+Fashion Confederation, ITV Denkendorf).
- The group recommended placing the focus of communication on a **differentiated consideration of exposure and toxicological effects of the employed materials**.

Discussion items on nanosilver in the textile sector

- The group agreed that **better communication from differentiated positions** on handling nanosilver in the textile sector is recommendable for all those participating. Press releases as well as documentations of dialog results and standpoints need to be more sensibly revised, in order to avoid polarization or simplifications in a situation where the present knowledge is still inadequate. To achieve this, improved cooperation between technical experts and communication officers would be necessary. This applies to companies, public authorities, scientific organizations and civil society actors in equal measures.
- Different parties repeatedly stressed that nanosilver applications cannot be generally rejected on the basis of the present state of knowledge, but rather that the **range and type of applications and their respective meaningfulness** need to be discussed. For example, a differentiation must be made between sportswear and medically necessary textiles, for allergic people or in hospitals.
- The group determined that the core of the debate is the **use of biocides** in consumer-related products and that narrowing the discussion to a “nano-debate” rather misleads consumers.

“**I think that looking for solutions for problems related to nanoapplications in consumer-related products in a dialog with interested stakeholders is a good approach. Different points of view confronted one another in the Dialogforum. For me the impression was clear that all those participating were really interested in finding solutions.**”

Christina Meßner, Textile+Fashion Confederation
3.6 Expertise in paints and varnishes

3.6.1 Release of nanoparticles from varnishes containing nanoscaled pigments or additives: Research methods and state of standardization

Expert: PD Dr.-Ing. habil. Michael Stintz, Dresden University of Technology

The release of nanoparticles from paints and varnishes as well as the methods and the state of measurement technology were discussed in detail by the guest expert from the Dresden University of Technology. Numerous studies on nanoparticle release via abrasion and sanding processes, drilling, sawing or incineration have already been published in the scientific literature (see Appendix III). Yet it remains a challenge to simulate realistic treatment scenarios, to analyze released particles at the site of their origin and to avoid contaminations from other particle sources. From a metrological point of view, particle number concentrations, number-weighted particle size distributions as well as particle species must be determined. As an example, the expert presented a current study on the release of nanoscaled pigments from artificially weathered acrylate varnishes. The samples were exposed to 1000 hours of dry light-dark cycles as well as 1,500 hours of dry-wet cycles. Wind erosion, dynamic friction as well as sanding were simulated. According to the study, particle release due to wind erosion and dynamic friction remains negligibly low. Pigments with dimension significantly larger than the nanoscale were transferred on the contact materials during dynamic friction and sanding. The artificial weathering of the varnishes led to an increase in the sanding-induced particle release.

In addition, the work of the International Organization for Standardization (ISO) on standardization procedures in Technical Committee 24 as well as the in Subcommittee 4 (Research group “Representation of Analysis Data”) was presented. The individual definitions that are used in the documents can be examined in the ISO Online Database (https://cdb.iso.org). Other ISO documents (e.g. the ISO/TS 80004 Series) can be obtained on the ISO webpage, subject to a charge.

Discussion items

- The fact that most test methods are frequently assessed as being inadequate was critically discussed. This is due to deficits in the standardization with regard to specific treatment processes and scenarios.

- Particle measuring methods should be coupled with standardized treatment scenarios. Sanding of automotive paint for repair purposes would be an example in this context. A first approach toward a solution is described in the ISO/TS 12025 on the release of nano-objects from powdery nanomaterials.

- It was remarked that methods for water sample analyses have not yet been adequately standardized. In this case, the group sees the necessity of further development in risk research.

- The industry considers the general public and the media’s focus on the risks (toxicity of nanomaterials) to be problematical. The group recommends demonstrating the subject of a possible exposure using graphics: e.g. abrasion due to sanding processes, through wind erosion or subsequent to weathering. Referral to the results of research work on exposure as well as to studies on toxicity and ecotoxicity is recommended.
3.6.2 Leaching of nanoparticles into the environment

Expert: Prof. Dr. Michael Burkhardt, HSR University of Applied Sciences Rapperswil

Challenging methods for the analysis of nanoparticles in environmental water samples were in the focus of the expert contribution from the HSR University of Applied Sciences Rapperswil, Switzerland. It was recommended that data in this field of research should be urgently brought forward, also in order to meet the requirements of many environmental organizations. In order to improve the data on the environmental behavior of nanomaterials, it is necessary to improve the knowledge exchange across the rather separate disciplines of toxicology and exposure research. If one considers transport to water, there are different possible routes of exposure for nanomaterials that have to be considered: Via agriculture or storm water runoff of separated sewer systems, diffuse entries into the soil can occur. In settlements, the materials can either enter surface waters or ground water via sewage plants or diffuse entries (soil). In this context, sewage treatment plants are considered to be point sources in which it is possible to retain noxious substances with different technologies. Because diffuse entries via storm water runoff enter waters directly and unfiltered, the leaching of nanoparticles is particularly relevant, with regard to environmental impact. The task now is to develop appropriate methods for determining the mass flow of these entries.

In the presented study, the leaching of titanium dioxide and nanosilver from facades was investigated. The TiO2 represented the nanoscaled fraction of whitening pigments in facade paints. The facade runoff of a model house was analyzed for a period of 372 days. Insights were gathered using both scanning electron microscopy and chemical analysis. The results show that facades count as diffuse sources for particles released into soil and waters. Nanosilver leached rapidly (30%, and 50% of it during the first three months after painting), whereas titanium dioxide was released much less strongly. However, both nanosilver and titanium dioxide are seldom released as individual particles, but instead as micro- or macroparticles. How particles of this size behave in the environment was not the object of this study; data still have to be generated on this.

“As an invited expert, I received a friendly reception from the platform. The overweight of industry representatives was obvious, but fortunately the classic “fronts” became blurred in the course of the workshop. It was however regrettable that group-specific behavior patterns subsequently reappeared. From my point of view, the essential foundations for the determination of possible benefits and risks of nanomaterials are transparency and honesty in communication. Consumers, the media and scientists quickly notice whether these requirements are fulfilled. The workshop was a step toward better discussion culture—primarily comprised of “listening”. I personally appreciated the fact that manufacturers are frequently more pragmatic and future-oriented than industrial associations.”

Prof. Dr. Michael Burkhardt, HSR University of Applied Sciences Rapperswil (HSR)
Discussion items

- As a joint conclusion of the two exposure studies, it was apparent that products or applications in which nanoparticles are used, do not necessarily release nanoscaled individual particles but frequently larger agglomerates instead.

- Whether one can speak of a "release of individual nanoparticles" is to be investigated. The group emphasized the necessity of increasing interdisciplinary research for this purpose.

- The question as to the extent that different risk potentials exist for nano-, micro- or macroparticles remained open.

- The experts recommended that the agglomeration status should be considered in respective "ecotoxicological tests".

3.6.3 Application examples of nanotechnology in exterior facade paint and automotive paints

Expert: Dr. Peter Bachhausen, BASF Coatings GmbH

In general, paints and varnishes consist of binding agents / coating resins, pigments and fillers, which generate corrosion protection and the coloration, and of additives and solvents, which have a stabilizing or conserving effect. Solid materials are added and dispersed in the binding agents and solvents. The formulation is subsequently completed with fluid or pasty additives and tested.

With regard to occupational safety, substance data on raw materials, intermediate and end products including contaminants, ancillary and operating substances with their respective particle size distributions are initially recorded. Subsequently, substances, processes or activities are assigned and conditions of substance use (solid material handling, fluid dosing, object suction) clarified. With regard to the procedure, protective measures are checked against the background of statutory and company-internal regulations and thus risks, exposures and emissions are determined. In the production of paints and varnishes, exposure to nanoparticles depends on both the material properties (e.g. dustiness) and on the speed of the charging with solid materials. An effective technical suction and technical ventilation are thus central elements for industrial safety. If necessary, in addition to the technical exhaust system, protection can be achieved by means of filter masks (P2 or P3 filter).

With regard to the achieved properties, it would be more appropriate to speak of nanostructured materials than of nanoparticles when referring to paints and varnishes. When coated with binding agents or embedded in a polymer matrix, nanoparticles lose their original properties. However, by sedimenting solid paint constituents, new nanostructural properties can be obtained and produced in a targeted manner.
Discussion items

- It was critically noted that scientific results on stability of the nanomaterials embedded in composites are not yet available. "The end-of-life question" has thus not yet been investigated and could not initially be assessed as a priori. In this context, scientific and civil society groups recommend a differentiated communication on the knowledge gaps and an intensification of research efforts.

- The Oeko-Institut’s recommendation to use P3 filters when nanoparticles are applied was discussed. Here the expert explained that, according to the relevant regulations from German institutions for statutory accident insurance and prevention, P3 filters are preventively required only if materials with certain toxic properties are being used.

- Whether an effective technical exhaust system is adequate as a preventive measure should be tested. According to the group, the use of P3 masks should not be extended to all nanomaterials as a general recommendation. A specification for certain materials (e.g. for fibrous nanomaterials) and a restriction of the wearing times were discussed. The group stressed the priority of general technical measures over individually worn measures.

3.6.4 Activities of the German Paint and Printing Ink Association

Expert: Dr. Dietmar Eichstädt, German Paint and Printing Ink Association

The German Paint and Printing Ink Industry generates a 7 billion euro turnover annually and employs 25,000 people in Germany—primarily in small and medium-sized companies. Many paint and varnish products in which nanomaterials are used are already on the market. Among them are self-cleaning coatings, effect varnishes, antibacterial paints, highly scratch-resistant coatings, photocatalytic paints as well as clear coatings with improved UV protection. Possible future developments include: thermal insulating wall paints, self-healing, electrically conductive or switchable coatings as well as coatings for photovoltaic generation of electricity.

The Association commissioned a study on the release of nanoparticles from a coating matrix by the Dresden University of Technology. Parquet varnish, furniture varnish as well as water-based construction varnish with zinc oxide nanoparticles were investigated. In addition to everyday wear (sandy shoes), abrasion by sanding (also after 500 h and 200 h of aging) was simulated in the study. The results show that the number of released nanoparticles is either at the detection limit or very low. Other studies in Denmark and France confirm these results. Therefore, the Association concludes that no indications of risks exist.

In its dialog activities the Association has adopted the five dialog principles of the German Federal Government’s NanoKommission. Additionally, a guideline for handling nano-objects in the workplace has been prepared. Several current political developments in the nano-sector were
critically commented on. The Association considers both the Expert Opinion of the German Advisory Council on the Environment (SRU 2011) with its “abstract concern” and the regulation requirement resulting from it, as well as the new EU definition recommendation problematical. For an EU-wide product register, the products to be registered would have to be precisely differentiated so that not all coated products would have to be listed as nanomaterials. The effort would be great and the information value for stakeholders or consumers close to nil. For this reason, the VdL opposes a comprehensive product register or all-inclusive labeling.

Discussion items

- In the discussion on the risk assessment of paints and varnishes, it was stressed that also in case of a low exposure probability (e.g. resulting from embedding in a matrix) the hazard of a substance has to be determined when it is approved. The “no exposure = no risk” equation was considered an inappropriate reduction of the discussion both by the civil society groups and representatives of science. However, according to REACH, determining hazardousness is primarily the task of the producers of raw materials.

- According to the risk assessment definition of the German Federal Institute for Risk Assessment, both dimensions (exposure and toxicity / hazard) must be considered and tested in individual cases. Across-the-board assessments were critically viewed.

3.6.5 Nanopaints and nanostories: Techniques and marketing of nanomaterials in construction paints and varnishes

Expert: Dr. Helge Kramberger, Dr. Robert-Murjahn-Institut GmbH (DR-RMI)

The DR-RMI belongs to the Deutsche Amphibolin-Werke (DAW) company group, which manufactures paints and varnishes for industrial, commercial and consumer use.

Although no uniform definition of nanomaterials currently exists in the paint and varnish sector, the DAW introduced already many years ago a definition of its own, based on the definition of the German Chemical Industry Association (VCI). According to the DAW approach, nanomaterials have: 1) at least two dimensions in a size range of < 100 nm; 2) a significant mass fraction; and are 3) “new”, specially produced nanomaterials with new properties. In such cases, a separate assessment is conducted before their release. According to these internal criteria, very few DAW products contain nanomaterials; less than 10 “nano raw materials” are used. In this context, it was critically compared that according to the new EU definition recommendation nearly all DAW products contain nanomaterials.

The most important application of nanomaterials at the DAW is the use of transparent iron oxide pigments, which protect wood stains against UV radiation. Other DAW applications are additives (e.g. silver as a pot preservative) or nanosilica for scratch-resistant industrial paints and varnishes.
The subject of “nano-presumptions” was critically highlighted. Industry-wide there are many products, which are suspected of having nanomaterials or nanoeffects but do not contain nanomaterials. For construction coating materials, true nanomaterials are generally too expensive and simpler technologies are more attractive. As a positive example for nanoproducts, a facade paint advertised as using “nano-quartz technology”, was presented. The paint generates a nanostructured surface. Material protection and durability (less soiling, longer renovation cycles) are the main benefits and also relevant in the sustainability sense. The properties were tested and confirmed in natural weathering tests in Istanbul and in Germany.

In the customer communication, brochures and online information are made available for do-it-yourself customers. In the professional sector, more actors require more structured information: end customers, dealers and painting contractors, specialist publications as well as the German statutory accident insurance organizations are all part of the communication chain. As an example of transparent communication, Dr. Kramberger presented the freely accessible nanoproduct database of the BG BAU (German Institution for Statutory Accident Insurance and Prevention, Building and Construction Industry) which the DAW supports as a manufacturer.

Discussion items

- The use of a company-specific definition was viewed critically. The resulting communication is not transparent for consumers and could be negatively interpreted, as being misleading.
- The group recommended use of the customary international definitions in accordance with ISO and the European Commission. The company would still have the opportunity to provide additional information on the extent to which these definitions apply to the respective product and which properties the materials have (see recommendation in Chapter 2).

“When new technologies provide new possibilities, but also bear new risks, it is absolutely necessary to gather all those involved – from research to the manufacturer up to all those who are affected by the benefits and the effects – on one table and initially to determine a common language and to develop mutual understanding. It would be very desirable if this were to happen much more frequently in such an open and constructive environment as the Dialogforum Nano. The innovative suggestions which we have heard here will certainly make it easier for us to arrange the necessary information exchange on the topic of nanomaterials in a more directed and better comprehensible manner for our customers.”

Dr. Helge Kramberger, Dr. Robert-Murjahn-Institut GmbH
The following graphic demonstrates the course of the Dialogforum Nano of BASF 2011/2012 in terms of workshops (WS) and telephone conferences (Telco):

<table>
<thead>
<tr>
<th>Time</th>
<th>Workshop/Telco</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2011</td>
<td>WS 1</td>
<td>Information exchange on the background, objectives and interests for this dialog phase, discussion of possible product examples</td>
</tr>
<tr>
<td>July 2011</td>
<td>Telco</td>
<td>Protocol consolidation, specification of the objectives: recommendations on information organization as well as on consumer communication, substantiation of possible examples and external partners</td>
</tr>
<tr>
<td>October 2011</td>
<td>WS 2</td>
<td>Joint determination of product examples, input of consumer inquiries: What do consumers want to know? First draft of the questionnaire for the supply chain</td>
</tr>
<tr>
<td>November 2011</td>
<td>WS 3</td>
<td>Clarification of terms, substantiation of questionnaire, selection and invitation of partners related to product examples, formation of product work groups</td>
</tr>
<tr>
<td>December 2011</td>
<td>Telco</td>
<td>Finalization of the application-related questionnaire</td>
</tr>
<tr>
<td>January 2012</td>
<td>WS 4</td>
<td>1.5-day workshop on dirt-repellent and antibacterially active textiles with scientific experts and representatives of the industry association, discussion of information requirements and possible recommendations on communication for specific examples</td>
</tr>
<tr>
<td>February 2012</td>
<td>Telco</td>
<td>Protocol consolidation, suggestion for the product-related recommendations</td>
</tr>
<tr>
<td>March 2012</td>
<td>WS 5</td>
<td>1.5-day workshop on paints and varnishes with scientific experts and representatives of the industry association, discussion of information requirements and possible recommendations on communication for specific examples</td>
</tr>
<tr>
<td>June 2012</td>
<td>Telco</td>
<td>Protocol consolidation, suggestion for the product-related recommendations, consolidation of the first text elements of the final report (on definition and societal background), further work assignments for the final report</td>
</tr>
<tr>
<td>June 2012</td>
<td>WS 6</td>
<td>1.5-day workshop on the 1st draft of the final report, work on the text elements on assessment and continuation</td>
</tr>
<tr>
<td>July 2012</td>
<td>Telco</td>
<td>Consolidation of final report</td>
</tr>
<tr>
<td>September 2012</td>
<td>Telco</td>
<td>Finalization of final report</td>
</tr>
<tr>
<td>October 2012</td>
<td>2 Telco</td>
<td>Finalization of final report</td>
</tr>
<tr>
<td>November 2012</td>
<td></td>
<td>Publication with closing event in Berlin</td>
</tr>
</tbody>
</table>

The DIALOG BASIS team has conceived, organized and moderated the Dialogforum Nano of BASF on behalf of the Risk Dialogue Foundation, St. Gallen, Switzerland, since 2009. Characteristic for the results-oriented dialog moderation is the change between small and large groups to go into more detail in subject areas as well as the use of simultaneous protocols for the joint development of contents.
Appendix II: Embedding in the nano-debate

In the Dialogforum Nano of BASF, the participants used the opportunity to discuss and comment on important subject areas or results of national and international nano-debates. A side effect of this dialog module was a clearly improved understanding of the different perspectives as well as a mutual learning process in which a great deal of information was compiled. The following subjects were discussed:

- Special expert opinion of the German Advisory Council on the Environment (SRU), in this case particularly the recommendations for regulation, based on an "abstract concern".
  
  
  http://www.umweltrat.de/SharedDocs/Downloads/EN/02_Special_Reports/2011_09_Precautionary_Strategies_for_mangining_Nanomaterials_KFE.pdf;jsessionid=B00063FFD2589776567C03F19F22DD91.1_cid325?__blob=publicationFile

- The BUND (Friends of the Earth Germany) demand for renunciation of nanomaterials in the organic sector.
  
  

- The Naturland Association for Organic Agriculture:
  
  

  
  Deutscher Bundestag (2012): Antwort der Bundesregierung auf die Kleine Anfrage der Abgeordneten Nicole Maisch, Krista Sager, Dorothea Steiner, weiterer Abgeordneter und der Fraktion BÜNDNIS 90/DIE GRÜNEN. 06.03.2012 (in German).
  
  http://dipbt.bundestag.de/dip21/btd/17/088/1708885.pdf

- Continuation of the NanoDialogue of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), in which the standpoints of the different stakeholders have become more rigid, according to some participants.
  
  

as well as the contents and results of its individual Expert Dialogs:

1. “Risk Management in the nano world” Documentation and background information (in German):
   

2. “Traceability of Nanomaterials” Documentation and background information (in German):
   
3 “Sustainability of Nanotechnologies – green nano”
Documentation and background information (in German)
http://www.bmu.de/service/publikationen/downloads/details/artikel/tagungsdokumentedes-3-fachdialogs-nanotechnologien/?tx_ttnews[backPid]=1091

- Activities on occupational safety in the Nanotechnology Working Group of the Committee on Hazardous Substances (AGS) in the German Federal Institute for Occupational Safety and Health:
  German Federal Institute for Occupational Safety and Health (2012): AGS zu Nanomaterialien (in German):
- An evaluation project regarding current EU regulation on work safety, funded by the DG Employment:
  http://www.rpaltd.co.uk/news-nanos.shtml
- Work of the European Forum “Social Dialogue” between companies and trade unions in the chemical industry, including a joint paper on responsible use of nanomaterials.
- EU legislative processes in the context of REACH (Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals) adaptations, particularly
  - Substance definition under REACH,
  - Toxicological work in the framework of the REACH Dossiers and
  - The revision of the Guidelines of the European Chemicals Agency (ECHA).
- The European Commission’s priority setting on the issue area of “Responsible Innovation”.
- Working processes in the OECD’s (Organisation for Economic Co-operation and Development) Working Party on Manufactured Nanomaterials (WPNM), to which different participants of the Dialogforum contribute.
- BASF’s decision to concentrate its activities in the plant biotechnology sector on the main markets in North and South America. Relocation of the BASF Plant Science company headquarters from Limburg-Hof, Germany to Raleigh, North Carolina (USA).
- The participants’ reports on interacting with media in press conferences, dialog events and television programs (e.g. “ZDF Zoom: Nanotechnologie – unsichtbare Gefahr? Aired 07.12.2011, in German).
- The VDI Nachrichten Article “BASF questions the German Nano-Consensus”, referring to a podium discussion in Brussels. Dealing with the media and the problems related to polarizations were subsequently discussed.
  http://www.ingenieur.de/Fachbereiche/Mikro-Nanotechnik/BASF-stellt-Nano-Konsens-in-Frage
Appendix III: Further studies, information, links

In the Dialogforum Nano, reports from the following research projects were presented:

- NanoDevice: http://www.nano-device.eu/
- UMSICHT (Research project of the German Federal Ministry for Education and Research (BMBF) on the environmental effects of nanomaterials used in the textile sector): http://www.umsicht.uni-bremen.de/index%20engl.htm
- The Nanosilver Conference of the German Federal Institute for Risk Assessment (BfR) in February 2012 on different metrological approaches and their reliability, contributing to chemical determination methods as well as to the exchange between physical and chemical methods for improved risk assessment: http://www.bfr.bund.de/en/press_information/2012/08/nanosilver__progress_in_the_sphere_of_analysis__gaps_in_toxicology_and_exposure-128942.html
- Study by the Institute for Ecological Economy Research (IÖW) providing an overview of 10 years of research on public awareness of nanomaterials, funded by of the German Federal Institute for Risk Assessment. In the project, a new representative survey was conducted in 2012 (in German): http://www.ioew.de/innovation-und-technologien/ projekt/Internationale_Untersuchung_von_Einflussfaktoren_auf_die_Wahrnehmung_der_Nanotechnologie/
- Initiation of a joint research project between the BASF SE, the German Federal Institute for Occupational Health and Safety (BAuA) and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) on the long-term health effects of nanomaterials after inhalative uptake: http://www.basf.com/group/pressrelease/P-12-257
- New research projects of the German Paint and Printing Ink Association, conducted with additional project partners or research institutes, respectively
  - on the migration behavior of nanoscaled pigment particles from printing ink films of printed food packages onto the package contents and
  - on the migration of nanoparticles from a coating matrix.
- Study of the German Bishops’ Conference on genetic engineering, global nutrition and ethanol, with connection to societal risk assessment.

Links on the characterization and risk assessment of nanomaterials

- NanoGEM, a research project funded by the German Federal Ministry of Education and Research on the risk assessment of internal and external nanoparticle contact with organisms: http://www.nanogem.de/cms/nanogem/front_content.php?idcat=123&lang=11
The German Federal Government’s NanoKommission’s recommendation on the preparation of a product data sheet (in German):

Precautionary criteria of the German Federal Government’s NanoKommission in its report from 2008:

Instruments for a preliminary assessment of benefits and risks of nanomaterials in the report of the German Federal Government’s NanoKommission from 2011, as well as in the individual reports of the Issue Groups 2 and 4:


Criteria catalogue of the NanoKommission Issue Group 4 on the preliminary assessment of nanomaterials regarding their effects on people and on the environment (in German):

The Precautionary Matrix for Synthetic Nanomaterials of the Swiss Federal Office of Public Health (BAG):

http://www.umweltrat.de/SharedDocs/Downloads/EN/02_Special_Reports/2011_09_Precautionary_Strategies_for_managing_Nanomaterials_KFE.pdf;jsessionid=7E01774710670C5A49CE3A43D73FA80C.1_cid335?__blob=publicationFile


The NANO Dialogue Platform of the Swiss Federal Office of Public Health (BAG) and its recommendations for consumer communication and information. In the project a matrix for tiered information offerings as well as suggestions for companies on different information channels and contents were developed:

Links specifically on textiles

http://www.bfr.bund.de/cm/349/bfr_recommends_that_nano_silver_is_not_used_in_foods_and_everyday_products.pdf


Preparation of a ISO Standard together with the ITV Denkendorf, the Saxon Textile Research Institute and the TEGEWA group: http://www.din.de/sixcms_upload/media/1345/01_Berenger_28834.pdf

Links specifically on paints and varnishes

  


  
  [http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2918492](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2918492)

  

  

  

  

Links specifically on industrial safety, discussed in the workshops of the Dialogforum Nano:

- VCI (German Chemical Industry Association) & DECHEMA (Society for Chemical Engineering and Biotechnology) (2011): 10 Jahre Forschung zu Risikobewertung, Human- und Öko-toxikologie von Nanomaterialien (10 years of research on risk assessment, human and eco-toxicology of nanomaterials, in German).
  

  

- VCI (German Chemical Industry Association): Nanoparticle Exposure at Nanotechnology Workplaces.
  

  
Links to consumer-oriented publications or Internet portals

  http://www.bgbau.de/praev/fachinformationen/gefahrstoffe/nano

- BUND (Friends of the Earth Germany) (2009): Für einen verantwortungsvollen Umgang mit der Nanotechnologie (For responsible handling of nanotechnology, in German).


- BUND (Friends of the Earth Germany): Datenbank für Nanoprodukte (Database for nanoproducts, in German). Internet portal.
  http://www.bund.net/nc/themen_und_projekte/nanotechnologie/nanoproduktdatenbank/produkt suche/


  http://www.bfr.bund.de/en/frequently_asked_questions_on_nanotechnology-8568.html

  http://www.nano-sicherheit.de/

  http://www.nanoportal-bw.de/

  http://www.oeko.de/oekodoc/1161/2008-322-de.pdf

  http://www.vzbv.de/mediapics/nano_broschuere.pdf


  http://www.vz-nrw.de/UNIQ134210441213767/nano