How the Industry Copes with Emerging Risks due to New Technologies – The Case of Nanotechnology

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BASF SE
Senior Vice President Safety, Security and Emergency Response
June 2, 2009

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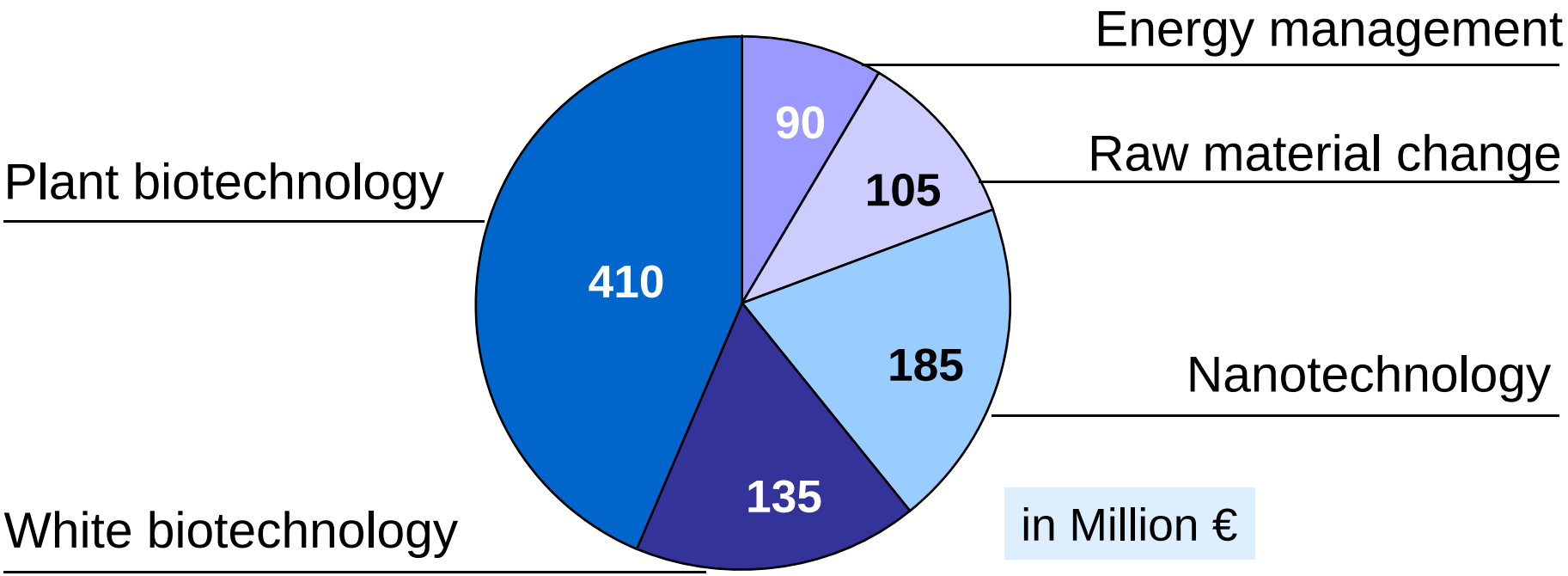
The Chemical Company

Nanotechnolgy: Innovation Driver for BASF

2006 – 2008: Investment into cross-divisional strategic research focusing in five growth cluster of about 925 Mio. €



Between 2009 and 2011 we continue our efforts with investments up to € 1 billion.

Nanotechnology: Contribution to climate protection

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Climate Protection

	Energy Efficiency	Energy Generation, Conversion & Storage
Marketplace	Ultradur® High Speed	
Development	Nanoporous Foams OLEDs	Organic Photovoltaics Li-Ion Batteries Nanocubes

According to a study of the British Defra, nanotechnology could reduce greenhouse gas emissions by up to 2 % in the near term and up to 20 % by 2050.

The study included fuel additives, photovoltaics, hydrogen technology, energy storage and heat insulation.

Nanotechnology enhanced sales products

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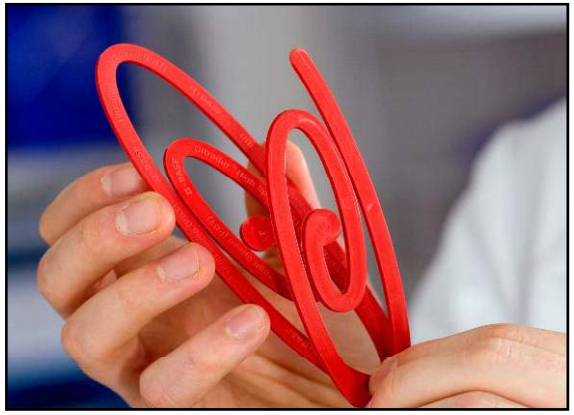
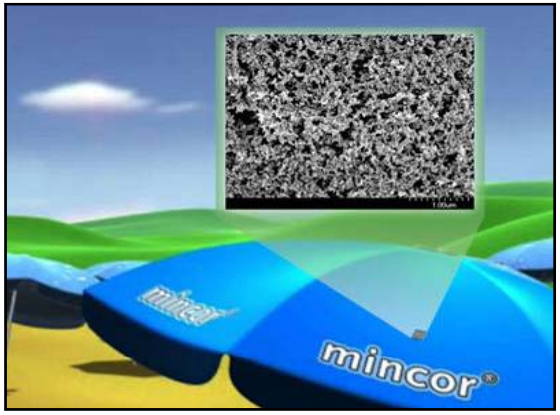
adhesion

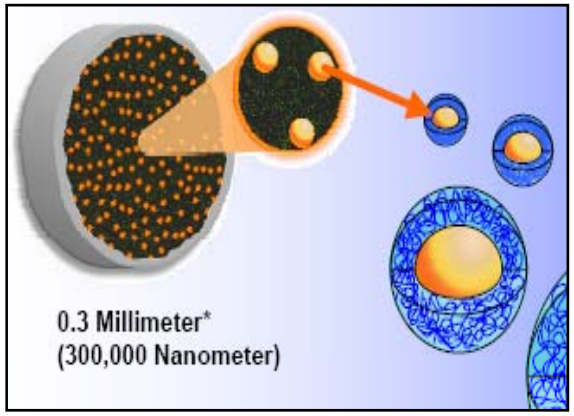


eco-efficiency



self-cleaning

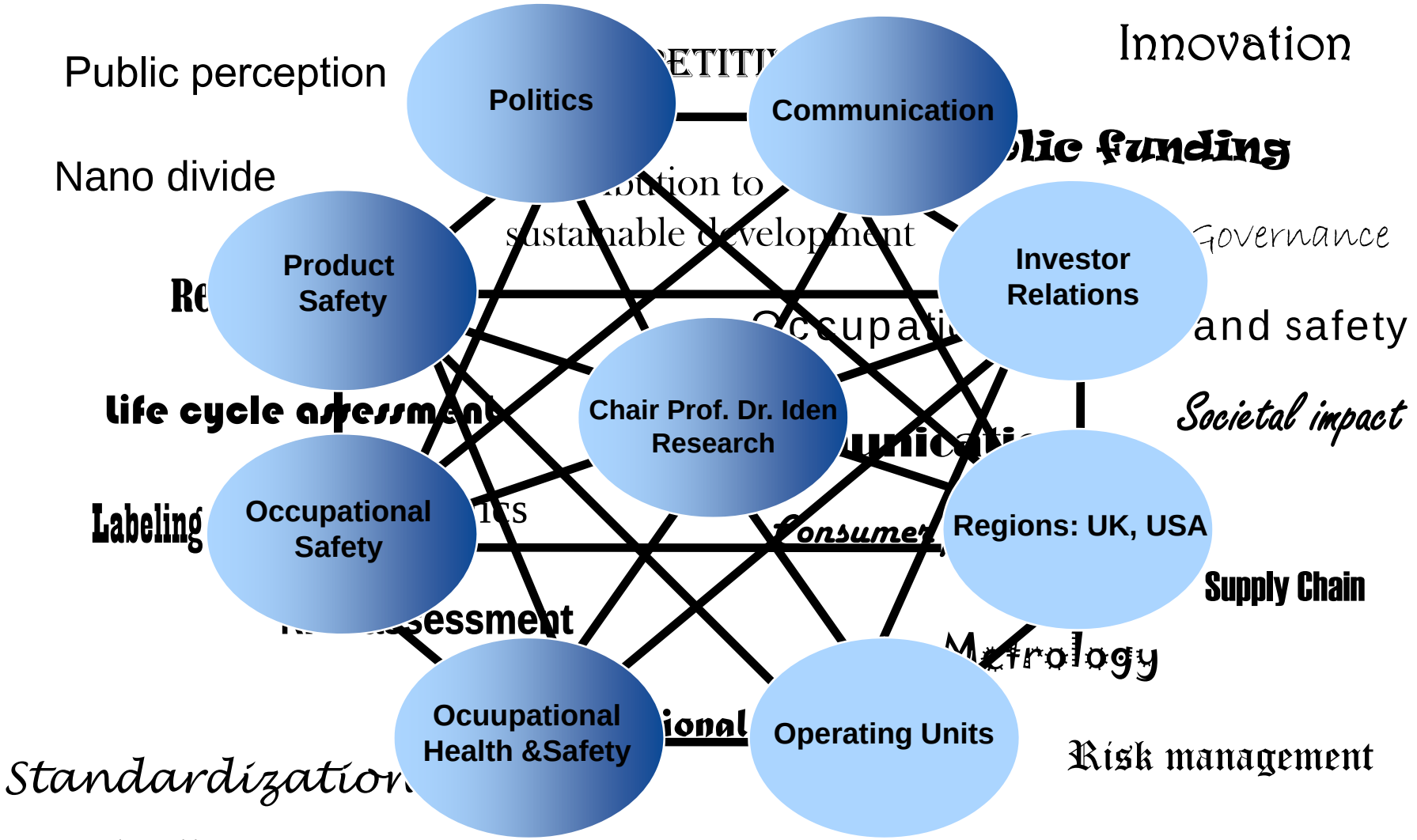
dirt-resistance



bioavailability

sun protection

Interdisciplinary EHS nanotechnology management at BASF

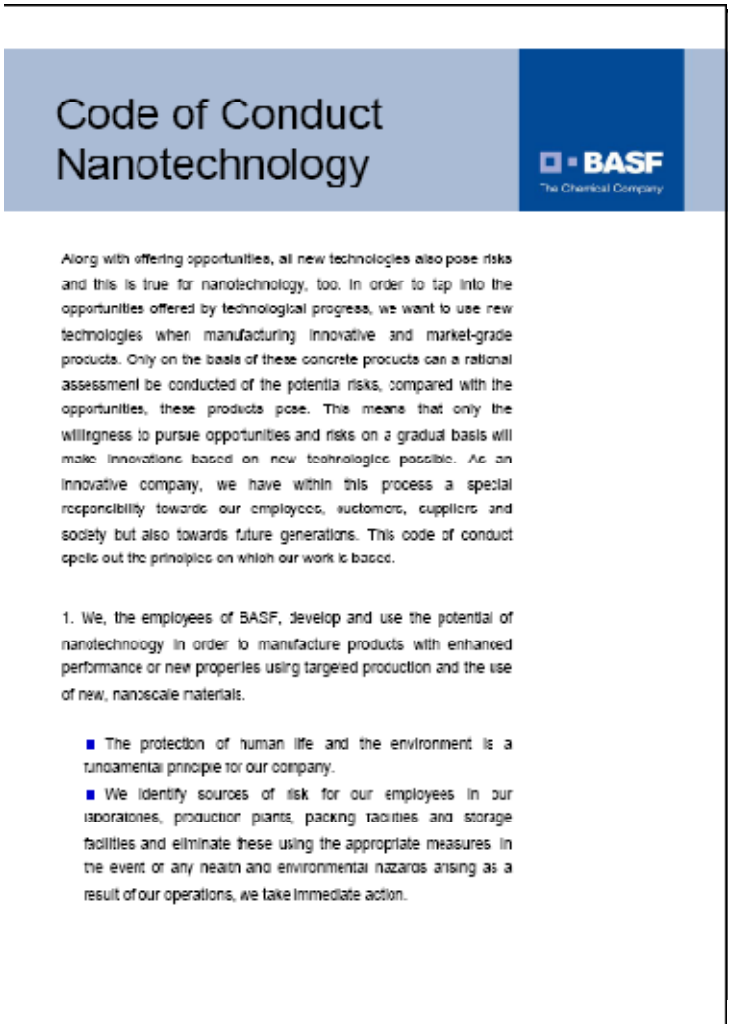


Responsibility: BASF Code of Conduct Nanotechnology

- The BASF Code of Conduct is a voluntary commitment to responsible action to:
  - protect employees, customers and business partners
  - protect of the environment
  - participate in safety research
  - communicate openly and to contribute to the public dialogue

- Support of VCI guidance on responsible production and use of nanomaterials

The BASF Code of Conduct describes the framework for our activities and is published on our website at: www.basf.de/dialogue-nanotechnology



Code of Conduct Nanotechnology

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Along with offering opportunities, all new technologies also pose risks and this is true for nanotechnology, too. In order to tap into the opportunities offered by technological progress, we want to use new technologies when manufacturing innovative and market-grade products. Only on the basis of these concrete products can a rational assessment be conducted of the potential risks, compared with the opportunities, these products pose. This means that only the willingness to pursue opportunities and risks on a gradual basis will make innovations based on new technologies possible. As an innovative company, we have within this process a special responsibility towards our employees, customers, suppliers and society but also towards future generations. This code of conduct spells out the principles on which our work is based.

1. We, the employees of BASF, develop and use the potential of nanotechnology in order to manufacture products with enhanced performance or new properties using targeted production and the use of new, nanoscale materials.

- The protection of human life and the environment is a fundamental principle for our company.
- We identify sources of risk for our employees in our laboratories, production plants, packing facilities and storage facilities and eliminate these using the appropriate measures. In the event of any health and environmental hazards arising as a result of our operations, we take immediate action.

Implementation of the Code of Conduct Nanotechnology: Occupational Safety

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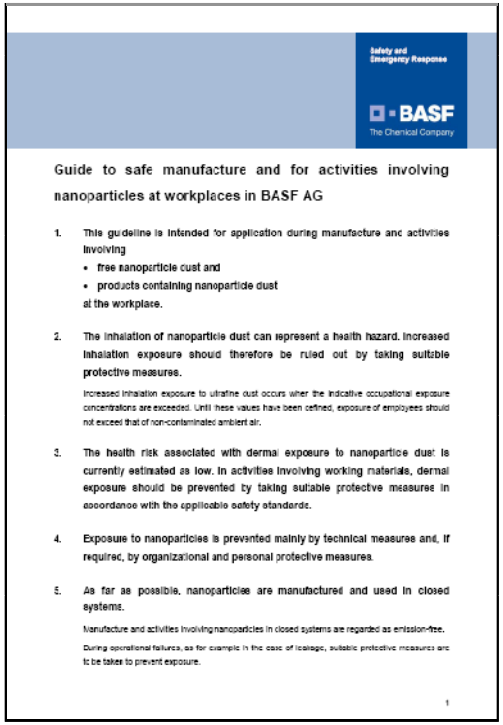
„We identify sources of risk for our employees in our laboratories, production plants, packing facilities and storage facilities and eliminate these using the appropriate measures.“

BASF Guide to safe manufacture of nanoparticles at workplaces:

- work as far as possible in closed systems
- if this is not possible, technical and organisational measures are taken
- working areas subject to nanoparticle emissions are monitored by exposure measurements
- BASF contributes to the development of measurement methods



Safety and Emergency Response

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Guide to safe manufacture and for activities involving nanoparticles at workplaces in BASF AG

1. This guideline is intended for application during manufacture and activities involving
   - free nanoparticle dust and
   - products containing nanoparticle dust

   at the workplace.

2. The inhalation of nanoparticle dust can represent a health hazard. Increased inhalation exposure should therefore be ruled out by taking suitable protective measures.

   Increased inhalation exposure to ultrafine dust occurs when the indicative occupational exposure concentrations are exceeded. Until these values have been defined, exposure of employees should not exceed that of non-contaminated ambient air.

3. The health risk associated with dermal exposure to nanoparticle dust is currently estimated as low. In activities involving working materials, dermal exposure should be prevented by taking suitable protective measures in accordance with the applicable safety standards.

4. Exposure to nanoparticles is prevented mainly by technical measures and, if required, by organizational and personal protective measures.

5. As far as possible, nanoparticles are manufactured and used in closed systems.

   Manufacture and activities involving nanoparticles in closed systems are regarded as emission-free.

   During operational failures, as for example in the case of leakage, suitable protective measures are to be taken to prevent exposure.

1

Implementation of the CoC Nanotechnology: Proactive communication with employees

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Direct talk with the supervisor

Dialogue Events

2008 and 2009: Dialogue event jointly organised with labour union and workers council on innovation, politics, occupational safety and toxicology

Hotline

Nano Contact Point introduced 2006. Each employee is requested to seek nano experts advice if working with these materials

BASF Media

Information e.g in company newspaper or intranet

LEITFADEN:

Sicher mit Nanomaterialien umgehen

Sie ist eine Schlüsseltechnologie des 21. Jahrhunderts: die Nanotechnologie. Für den sicheren Umgang mit Nanomaterialien hat die Einheit Arbeitssicherheit (GUS/D) jetzt den „Leitfaden zur sicheren Herstellung und bei Tätigkeiten mit Nanopartikeln an Arbeitsplätzen in der BASF" veröffentlicht. Dieser bietet eine Orientierungshilfe für Arbeitsplätze, an denen Nanomaterialien produziert oder verarbeitet werden.

Ein Beispiel ist die Ultramidfabrik. Dort werden Vorprodukte verarbeitet, die Nanopartikel enthalten. So wird hier Titandioxid in den Ausgangsstoff für Garne, Polyamid (Nylon), eingearbeitet. Die BASF verkauft dieses Produkt als Granulat unter dem Markennamen Ultramid®B S416N. Titandioxid absorbiert und reflektiert die Sonnenstrahlung.

Damit ein hoher Sonnenschutzfaktor erreicht wird und sich das Material dennoch zu feinsten Garnen verspinnen lässt, muss das Titandioxid in der Ultramidfabrik in Form kleinster Partikel verarbeitet werden. „Mit der zunehmenden Verwendung in der Produktion steigt auch der Bedarf an zusätzlichen Informationen über Arbeiten mit den Nanomaterialien", sagt Dr. Stefan Engel, Spezialist für Nanotechnologie in der Einheit Gefahrstoffmanagement (GUS/TD). „Bei Produkten mit neuen Stoffeigenschaften steht für uns die Vorsorge im Mittelpunkt. Der jetzt veröffentlichte Leitfaden dient deshalb vor allem dazu, das Niveau der Schutzmaßnahmen kontinuierlich weiterzuentwickeln", so Engel. Die Einheit Gefahrstoffmanagement erläutert darin, wie angemessene Schutzmaßnahmen von Raumlüftungen bis hin zu speziellen Staubmasken eventuelle Expositionen der Mitarbeiter vermeiden können. Besonders aufschlussreich sind laut Engel regelmäßige Partikelmessungen in den Arbeitsbereichen, in denen eine Emission von Nanopartikeln nicht vollständig ausgeschlossen werden kann.

Dazu wird ein speziell entwickeltes Messgerät eingesetzt. Um Erfahrungen mit dieser neuen Methode zu sammeln, werden solche Messungen nun auch in der Ultramidfabrik durchgeführt. Dort wird die Konzentration der Staubpartikel in der Arbeitsumgebung regelmäßig erfasst und mit der allgemeinen Hintergrundbelastung verglichen. Dr. Robert Weiss, stellvertretender Betriebsleiter der Ultramidfabrik (G-KT/LF), erläutert: „Mit diesen Messungen wollen wir einen Beitrag zur Weiterentwicklung adäquater Messmethodik für die BASF und die Gesellschaft leisten." cn

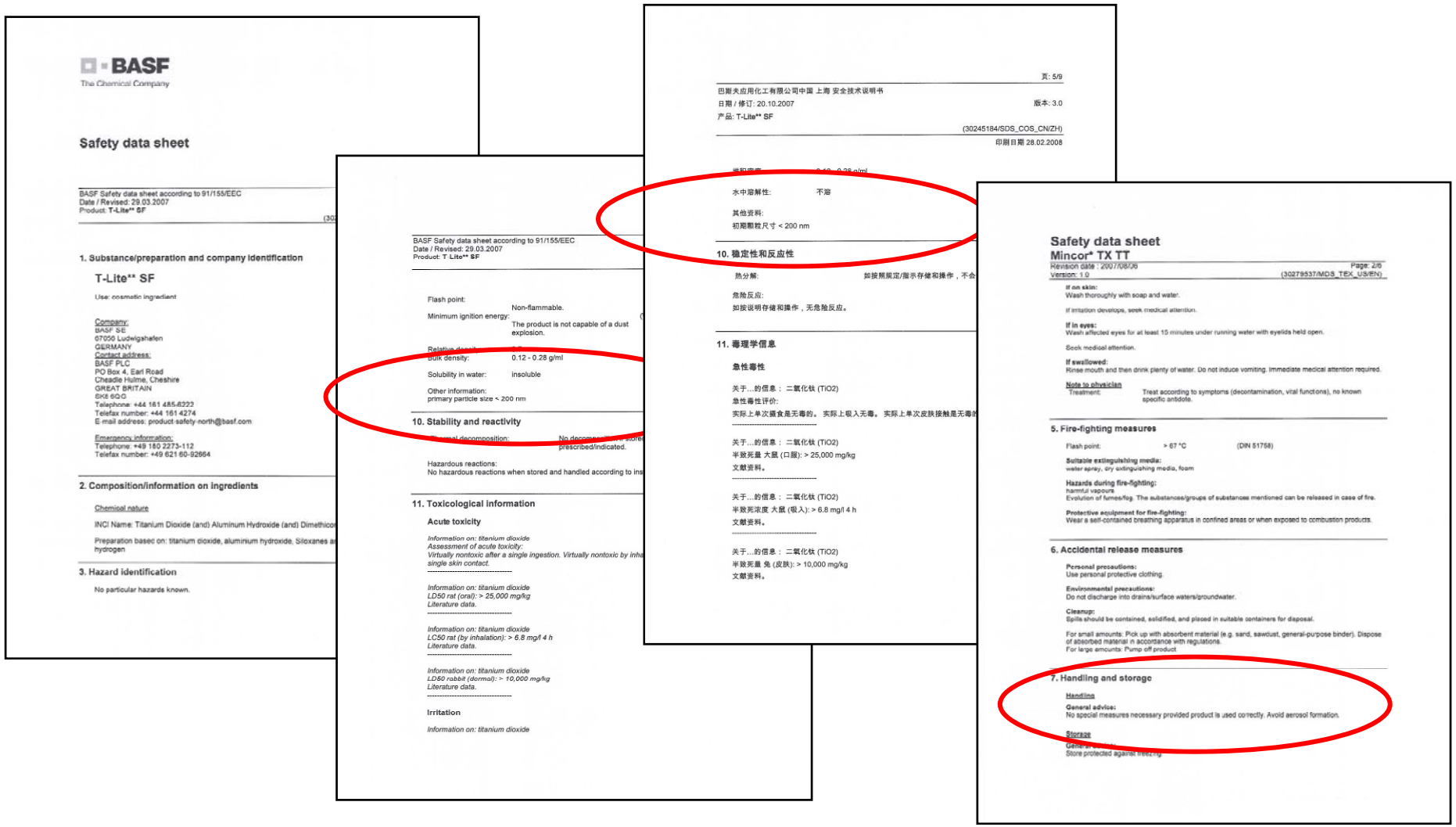
Der Leitfaden ist abrufbar auf der GUS-Homepage, Rubrik „Gefahrstoffmanagement", „Neue Regelungen". Näheres bei Dr. Stefan Engel (GUS/TD), Telefon 41614.

Manfred Sprenger (GUS/TD) misst die Konzentration der Nanopartikel vor Ort. Foto: BASF

Implementation of the CoC Nanotechnology: Information of customers

- Circulation of information along the supply chain
- Communication via contracts, technical information, hotlines, customized training workshops or safety data sheets (SDS).
- SDS are automatically sent to the customer.
- SDS contains information on composition, first aid measures, accidental release measures, exposure control and personal protection as well as toxicolo-gical information.
- BASF has up-to-date SDS available in 34 languages.
- The company started to include specific information on nanoparticle handling in the SDS.

Implementation of the CoC
Nanotechnology: Information of customers



Safety data sheet

BASF Safety data sheet according to 91/155/EEC
Date / Revised: 29.03.2007
Product: T-Lite** SF

1. Substance/preparation and company identification

T-Lite** SF

Use: cosmetic ingredient

Company:
BASF SE
67056 Ludwigshafen
GERMANY

Contact address:
BASF PLC
PO Box 4, Earl Road
Cheadle Hulme, Cheshire
GREAT BRITAIN
SK8 6QG
Telephone: +44 161 485-6222
Telefax number: +44 161 4274
E mail address: product-safety-north@basf.com

Emergency information:
Telephone: +49 180 2273-112
Telefax number: +49 621 60-92664

2. Composition/information on ingredients

Chemical nature

INCI Name: Titanium Dioxide (and) Aluminum Hydroxide (and) Dimethicon

Preparation based on: titanium dioxide, aluminium hydroxide, Siloxanes a
hydrogen

3. Hazard identification

No particular hazards known.

BASF Safety data sheet according to 91/155/EEC
Date / Revised: 29.03.2007
Product: T-Lite** SF

Flash point:

Minimum ignition energy: Non-flammable.
The product is not capable of a dust explosion.

Bulk density: 0.12 - 0.28 g/ml

Solubility in water: insoluble

Other information:
primary particle size < 200 nm

10. Stability and reactivity

prescribed/indicated.

Hazardous reactions:
No hazardous reactions when stored and handled according to ins

11. Toxicological information

Acute toxicity

Information on: titanium dioxide
Assessment of acute toxicity:
Virtually nontoxic after a single ingestion. Virtually nontoxic by inha
single skin contact.

Information on: titanium dioxide
LD50 rat (oral): > 25,000 mg/kg
Literature data.

Information on: titanium dioxide
LC50 rat (by inhalation): > 6.8 mg/l 4 h
Literature data.

Information on: titanium dioxide
LD50 rabbit (dermal): > 10,000 mg/kg
Literature data.

Irritation

Information on: titanium dioxide

页: 5/9

巴斯夫应用化工有限公司中国 上海 安全技术说明书

日期 / 修订: 20.10.2007 版本: 3.0

产品: T-Lite** SF

(30245184/SDS_COS_CN/ZH)

印刷日期 28.02.2008

水中溶解性: 不溶

其他资料:

初期颗粒尺寸 < 200 nm

10. 稳定性和反应性

热分解: 如按照规定/指示存储和操作，不会

危险反应:

如按说明存储和操作，无危险反应。

11. 毒理学信息

急性毒性

关于...的信息： 二氧化钛 (TiO2)

急性毒性评价:

实际上单次摄食是无毒的。实际上吸入无毒。 实际上单次皮肤接触是无毒的

关于...的信息： 二氧化钛 (TiO2)

半致死量 大鼠 (口服): > 25,000 mg/kg

文献资料。

关于...的信息： 二氧化钛 (TiO2)

半致死浓度 大鼠 (吸入): > 6.8 mg/l 4 h

文献资料。

关于...的信息： 二氧化钛 (TiO2)

半致死量 兔 (皮肤): > 10,000 mg/kg

文献资料。

Safety data sheet
Mincor* TX TT

Revision date : 2007/08/06 Page: 2/6
Version: 1.0 (30279537/MDS_TEX_US/EN)

If on skin:
Wash thoroughly with soap and water.

If irritation develops, seek medical attention.

If in eyes:
Wash affected eyes for at least 15 minutes under running water with eyelids held open.

Seek medical attention.

If swallowed:
Rinse mouth and then drink plenty of water. Do not induce vomiting. Immediate medical attention required.

Note to physician
Treatment: Treat according to symptoms (decontamination, vital functions), no known specific antidote.

5. Fire-fighting measures

Flash point: > 67 °C (DIN 51758)

Suitable extinguishing media:
water spray, dry extinguishing media, foam

Hazards during fire-fighting:
harmful vapours
Evolution of fumes/fog. The substances/groups of substances mentioned can be released in case of fire.

Protective equipment for fire-fighting:
Wear a self-contained breathing apparatus in confined areas or when exposed to combustion products.

6. Accidental release measures

Personal precautions:
Use personal protective clothing.

Environmental precautions:
Do not discharge into drains/surface waters/groundwater.

Cleanup:
Spills should be contained, solidified, and placed in suitable containers for disposal.

For small amounts: Pick up with absorbent material (e.g. sand, sawdust, general-purpose binder). Dispose of absorbed material in accordance with regulations.
For large amounts: Pump off product.

7. Handling and storage

Handling

General advice:
No special measures necessary provided product is used correctly. Avoid aerosol formation.

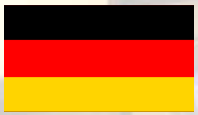
Storage

Store protected against freezing.

Implementation of the CoC Nanotechnology: Safety Research

- BASF internal projects (exposure measurements, method developments etc.)

- HESI / ILSI Nanomaterials Program
- ACC Nanomaterials Voluntary Program



- NanoCare

- NanoSafe 2
- CellNanoTox

Implementation of the CoC Nanotechnology: Safety Research

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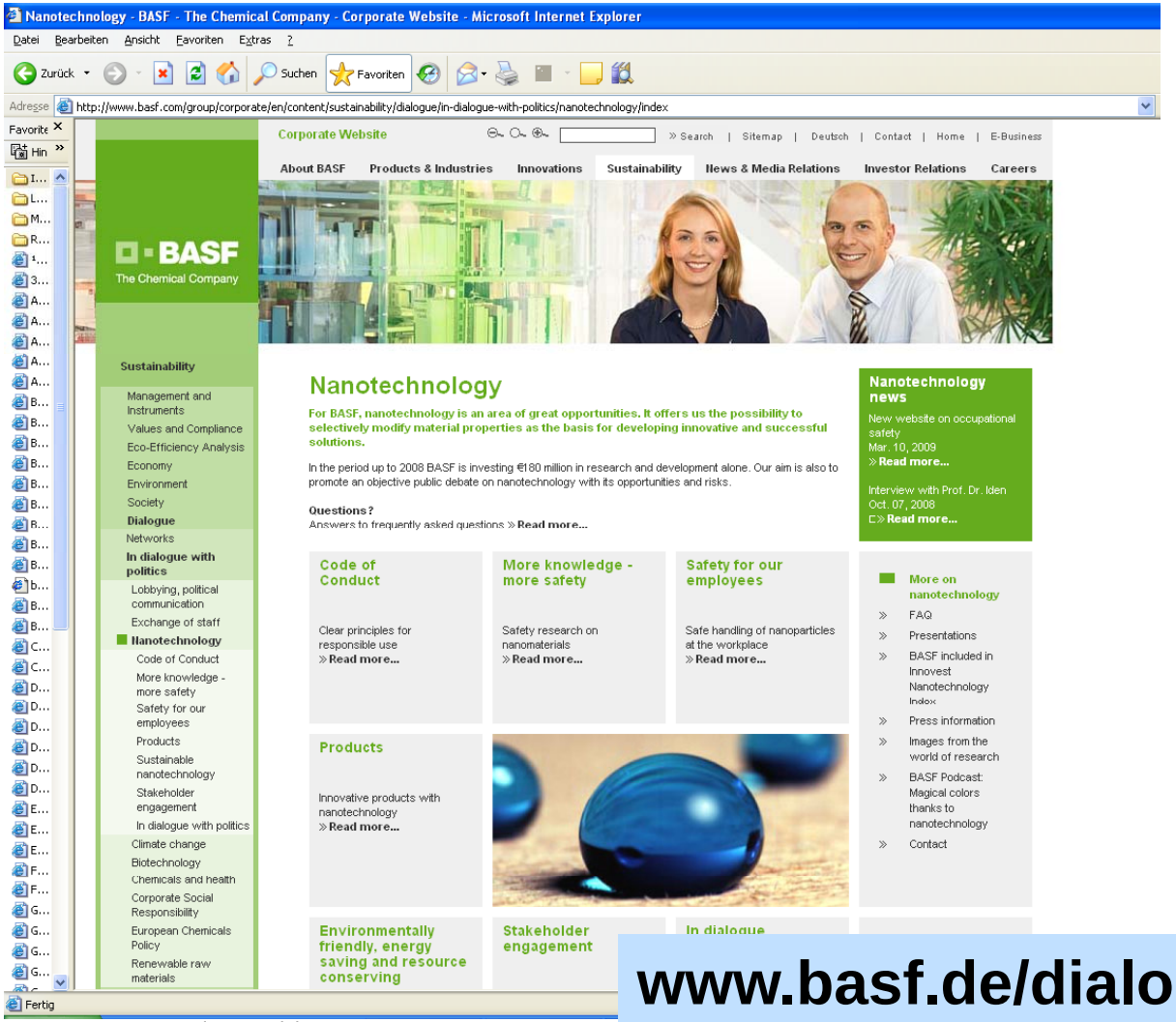
Progress in Nanotoxicology raises new questions:

Skin	Can nanoscale materials penetrate skin?
Lungs	How are nanoscale materials uptaken by the lungs and which effects do they have?
Body	How are nanoscale materials distributed in the body and which effect do they have?
Genetic Material	Can nanoscale materials damage the genetic material?
Environment	Do have nanoscale materials effects on animals and the environment?
Test Methods	How can the toxicity of nanomaterials be tested?

Implementation of the CoC Nanotechnology: BASF Dialogforum Nano

- BASF Dialogforum Nano established in 2008
- Goal: To build trust, to create transparency and bring forward issues currently discussed in politics and public
- Participants: Environmental groups, consumer groups, churches, sustainability think tanks
- 2 Events in 2008: One on neutral floor in Kassel, Germany, another at BASF Lu site including plant visit
- Issues:
  - Nanotechnology Governance (Regulation or self regulation)
  - Safety

Implementation of the CoC Nanotechnology: Transparency



Comprehensive website on nanotechnology

Issues covered are:

- BASF Code of Conduct
- Occupational Safety management
- BASF products
- Safety research
- Nanotechnology & sustainability
- BASF dialogues with politics and stakeholders

www.basf.de/dialogue-nanotechnology

Political Pressure is increasing in Europe

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Large majority for an update of EU legislation on cosmetics

- Labelling: Ingredients with the Prefix “Nano-“
- Safety assessment needed
- Strengthening manufacturer resposibility

Large majority for the legislative report on Novel Food

- A specific risk assessement for food being produced by nanotechnology
- Labelling: “(Nano)“ next to the ingredient

Own- initiative report (EP)

Support from all major parlamentarian groups for the Initiative Report on Regulatory Aspects

- Product Data Base
- Labelling of Nano products
- Regulatory Review

as well as NGO activities...

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etc group
action group on erosion, technology and concentration

ETC Group
News Release
April 14, 2003
www.etcgroup.org

Size Matters!

ETC Group: New information provides more evidence for mandatory moratorium on synthetic nanoparticles

The ETC Group today releases a new *Occasional Paper*, "No Small Matter II: The Case for a Global Moratorium – Size Matters!" The report calls on governments to adopt a moratorium on synthetic nanomaterials that are being manufactured in the laboratory and in some cases commercialized, in the absence of testing for health, safety and environmental impacts.

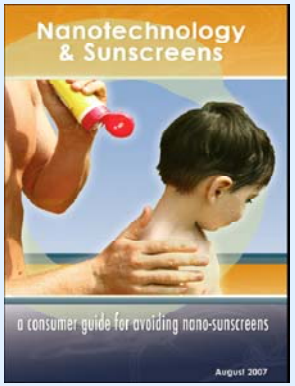
"Even though industry is scaling up the manufacture of nanoparticles and carbon nanotubes there appear to be no government regulations in Europe or North America to ensure the safety of workers or consumers," says Kathy Jo Wetter, ETC Group researcher. "A few national governments are beginning to consider some aspects of nanotech regulation but no government is giving full consideration to the socioeconomic, environmental, and health implications of this powerful new industry," notes Wetter. The ETC Group reports that nanoparticles are already available to consumers in sunscreens (including some intended for children, from infancy onwards) and cosmetics, among other products. However, regulators do not test nano-sized materials for health, safety and environmental impacts if their macro- or micro-sized counterparts have already been approved.

"In light of this astonishing negligence," says Pat Mooney, Executive Director of ETC Group, "and because consumers are already being exposed to synthetic nanoparticles, the call for a mandatory moratorium is the only reasonable policy response."

Atomtech (or nanotech, as the industry prefers to call it) refers to the manipulation of matter on the scale of the nanometer, where atoms and molecules are measured in billionths of meters. Ordinary materials such as carbon, when reduced to the nanoscale, often exhibit novel and unpredictable traits such as extraordinary strength, chemical reactivity, electrical conductivity, or other characteristics that the same material does not possess at the micro or macro-scale. Companies are already producing tons of nano-scale particles (pure elements, simple compounds and composites) for use in bulk sprays, powders and coatings. Today, nanoparticles are used in the manufacture of transparent sunscreens and cosmetics, scratch-resistant eyeglasses, stain-repellant fabrics, anti-graffiti coatings for walls, and more. Some of the materials are familiar compounds that have not previously been marketed on the nanoscale. Other synthetic forms of nano-scale carbon – such as nanotubes– are being manufactured for the first time and two recent studies indicate that they can cause damage to lung tissue in mice.

According to the ETC Group, the current market for nanoparticles is small, but analysts predict it will exceed $900 million by 2005. Some of the world's largest companies (DuPont, BASF, L'Oréal, Hewlett-Packard, Mitsubishi, Toyota, and IBM) as well as some of the world's smallest (NanoProducts, Nanophase, Altair) are ratcheting up nanomaterial research quickly.

„The smaller the particle, the more reactice and toxic their effect. This should come as no surprise, because this is exactly the way in which catalysts are made to enhance industrial chemical reactions."



Take home messages

- Nanotechnology is one of our key future issues.
- For BASF nanotechnology is an area of great opportunity: it offers us the possibility to develop innovative and successful solutions.
- Parallel to the technological development BASF implemented management structures to deal with related EHS issues.
- The basis for our responsible and sustainable development is our Code of Conduct.
- In line with our CoC, we implemented safety guidelines for our employees.
- Moreover, we actively particpate in the safety research for nanomaterials.
- In addition, we carry on an open dialogue with politics and the public.
- However: Public and political pressure is increasing, raising new questions for our strategy.

Thank you for your attention!

Zinc oxide particles protect against sunburn

Nanocubes can store energy-rich gases

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