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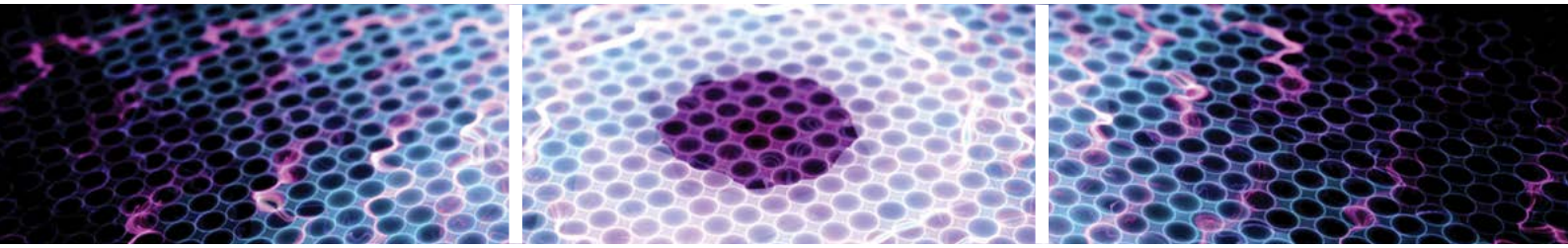

Risk Monitoring for Nanomaterials Helps Insurers Conduct Risk Analyses*

by Tobias Widler and Dr. Christoph Meili, The Innovation Society, St. Gallen, and Richard Wieczorek , Gen Re, Cologne

The systematic examination of nanomaterials and associated risks is of increasing importance to the insurance industry.

The insurance industry should aim to actively support nanotechnologies without losing sight of the risk potential from an underwriting perspective. In cooperation with The Innovation Society in St. Gallen, Switzerland, Gen Re has developed a risk monitoring system for engineered nanomaterials. The system is based on the collection of comprehensive scientific data and designed to support insurers in collecting and analysing potential nano risks in their portfolios.

Multifaceted materials with outstanding properties

Experts consider nanotechnologies[1] and nanomaterials[2] to be key technologies and key materials of the 21st century. All over the world, they are becoming ever more commonplace in industrial applications and consumer products. Many cosmetics, varnishes, plastics, electronic components and medical devices, construction materials, and even toner for printers (see box on p. 4) contain nanomaterials. Nanomaterials have the capacity to considerably improve material properties unlike to bulk materials.[3] They are used, for example, as invisible filters in sunblock and as components in energy-efficient displays or lighting. Due to their extremely small size, nanomaterials possess a comparatively large specific surface, which means increased reactivity. A plethora of nanomaterials and applications are currently either being looked into or are almost ready for market launch.

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About This Newsletter

Insurance Issues provides an in-depth look at timely and important topics on insurance industry issues.

Unknown long-term effects and regulatory gaps as risks

The insurance industry must face up to both the pleasant economic prospects associated with nanotechnologies and the potential risks emerging from them.

The risk profiles of nanomaterials are multilayered and complex. For some nanomaterials, the long-term effects on humans and the environment remain unknown. Some nanomaterials (such as certain carbon nanotubes, known as CNTs) may exhibit increased toxicity or even have carcinogenic effects. Yet current findings on the toxicity of nanomaterials are mainly based on animal or in vitro experiments. The impact of nanomaterials on human beings and the environment fundamentally depends on the type of material, physicochemical parameters, the form (free, suspended, bound) and exposure.

In many countries, nanomaterials are regulated within existing laws, just like conventional chemicals. Regulations adapted to the special characteristics of nanomaterials are not yet sufficiently established, and it may be a number of years until they are implemented. These conditions may lead to regulatory gaps. While some nano-specific regulations exist in the EU, no legally binding generic requirements or declaration obligations for nanomaterials have entered into force in the U.S.

Widespread use in consumer products and reputation risks

Nanomaterials are contained in many of consumer products. In general, consumers perceive nanotechnologies in a positive way and come into contact with a large number of nanomaterials (cosmetics, textiles, packaging, etc.), but the general population has very limited knowledge of nanotechnologies. However, they are critical of certain applications (such as, applications in food and cosmetics). Since many producers pursue reserved information policies and the declaration of nanomaterials is mostly not mandatory, manufacturers of nanoproducts face extensive reputation risks. Regardless of the actual toxicity of the materials in question, this could lead to losses in revenue. The problem is exacerbated by more rapid communication in social media and partly negative media coverage that focuses on the risks. In the course of "nano scandals" or other violent controversies, the reputation of nanotechnologies in general might be damaged.

Possible losses to liability insurance as a result of nanotechnologies

Based on the current state of the described developments, we affirm the potential of nanotechnologies to evolve into real risks for liability insurance policies. Given that nanotechnologies are commonplace around the world and can be found in numerous products and industries, many policyholders worldwide would be affected, which would considerably damage the insurance industry and entail consequences for almost all relevant areas:

- Public liability insurance
- Product liability insurance
- Environmental liability insurance
- Product recall
- Employer's liability insurance (workers' compensation, employers' liability)

A distinction between workplace and consumer exposure has to be made, since causality can be established more easily for workplace exposure.

Another important aspect for insurers is the unlimited defence costs granted within liability insurance policies. Claims based on alleged damages could increase substantially in the coming years. The complexity of nanotechnologies would lead to extensive and costly defence.

Nano risk monitoring with comprehensive risk focus

In order to enhance the insurability of companies manufacturing, processing or otherwise applying nanomaterials, Gen Re and The Innovation Society, St. Gallen have developed a risk monitoring system for engineered nanomaterials. The system is based on the collection of comprehensive scientific data and supports direct insurers in evaluating potential nano risks in their portfolios. In the process, the risk profiles of the most important nanomaterials are analysed and evaluated according to nine individual criteria, including toxicity, regulation,

reputation and accumulation risks. The materials are categorised into risk classes and the risk profiles are visualised. The monitoring is updated according to client requirements and the latest scientific data is integrated into the risk profiles. Based on initial monitoring results, Gen Re advises the insurance industry to focus more heavily on nanomaterials.

Differentiated risk profiles and clear classification of nanomaterials

Nano monitoring is specifically designed to meet the requirements of insurers and takes into account the complex risks and opportunities associated with nanomaterials. Nanomaterials are not per se more dangerous than other materials. Nevertheless, insurers and policyholders have to consider that certain nanomaterials exhibit an increased risk potential.

Figure 1 – Risk profile of nanoscale silver

The risk profile of nanosilver is displayed in Figure 1. Nanosilver (also called nanoscale silver or silver nano particles) was classified as a nanomaterial possessing high potential risks. The categorisation as a "red" material is based on the average rating of the nine individual criteria and illustrates the multidimensionality of nano risks. The classification results from the large number of products available on the market (consumer exposure), the related possible accumulation risks and uncertainties concerning direct and indirect impacts on human health (long-term effects, potential formation of bacterial resistance), etc. As a strong ecotoxic material, nanosilver is also garnering greater attention from NGOs, the media and the general public. A main source of contention is its widespread use in everyday products. Regarding regulation, it has to be emphasised that in some countries silver may be subject to strict limit values and pesticide regulations. Nevertheless, a large number of products containing nanosilver are available despite not having been previously registered.

Besides nanosilver, 16 further nanomaterials were analysed and evaluated. A total of five materials were categorised as high risk, eight as medium risk and four as low-risk materials.

Prominent examples of the "red" risk group are CNTs or nanoscale titanium dioxide. The International Agency for Research on Cancer (IARC) classifies certain types of both of these nanomaterials as potential carcinogens. In the case of titanium dioxide, aspects that make a difference are their application in cosmetics and the associated reputation risks, as well as the high tonnage and the pronounced photocatalytic activity (environmental effects). For CNTs, on the other hand, contributing factors to the high risk are the unclear long-term consequences for humans and the environment, reputation risks, and the low limits and specific regulations in different countries. There are low risks with materials such as dendrimers or nanoscale gold.

> Please keep in mind that the science evaluating the potential for adverse health effects caused by exposure to nanomaterials is still in the early stages. As such, future studies may result in a nanomaterial currently ranked as a "low" risk changing to a higher risk. Further monitoring is necessary.

Solvency II demands investigation into emerging risks

Within ORSA (own risk and solvency assessment), the new insurance supervisory system Solvency II requires the establishment of a risk management policy that covers all material risks, including emerging risks such as nanotechnologies. Insurance companies are obliged to regularly assess their own situations regarding current and future risks. Thus, insurers should take action in order to evaluate and permanently observe nano risks in their portfolios.

Conclusion

The insurance industry should aim to actively support nanotechnologies without losing sight of the risk potential. From an underwriting perspective, the risk monitoring approach presented here by Gen Re and The Innovation Society provides a sound basis for insurance companies. However, it will not suffice in terms of enabling controlled handling in the context of actuarial practices.

We recommend the following:

- Regular training of liability insurance underwriters and risk managers on nano risks
- Intensive examination of liability issues associated with these new technologies
- Implementation of portfolio transparency (materials, applications and producers) in order to enable assessments on potential exposure

Additionally, participation in a broad public dialogue, including potential risks, should be pursued. Such an approach will foster the significance of common problem-solving strategies between the insurance industry, policyholders, scientists, statutory accident insurance policies, etc.

Endnotes

* This article is a translation of an article published in the magazine *Versicherungswirtschaft* (Insurance industry): Widler, T., Meili, C., Wieczorek, R. (2015). Unbekanntes Terrain erkunden: Erkenntnisse zum Nano-Risiko-Monitoring. Versicherungswirtschaft. Vol. 70, Edition 5/2015, pp. 26 - 28.

1 Nanotechnology is the study of properties and the purposeful modification of materials on the atomic, molecular or macromolecular level.

2 Materials possessing structures with nanoscaled external dimensions (i.e. size range between 1 and 100 nm, where 1 nanometre corresponds to 10.9 metres) or internal dimensions and surface structures on the nanometre scale.

3 In this context, bulk material is to be understood as "conventional" material in delivery form, i.e. non-nanoscaled material.

4 Pirela, S. V., et al. Consumer exposures to laser printer-emitted engineered nanoparticles: A case study of life-cycle implications from nano-enabled products. Nanotoxicology 0 (2014): 1–9.

Ever more nanomaterials in toner

For a long time, occupational safety officers and metrologists have been looking at the emissions of (ultra-) fine particles in printing processes. Until now, they worked on the assumption that the majority of them are produced during the printing process, with at least some of them coming from paper itself. A recent study on laser printers demonstrates that many toner producers add increasing amounts of mostly engineered nanomaterials (including metals and metal oxides) to toner in order to enhance print quality.[4] As part of the study, 11 types of toner from four leading producers came under the microscope. The analysis of the particles emitted during the printing process showed that the added nanomaterials also entered the ambient air. Some of the printers emitted a great many particles. It remains to be seen whether the emissions have a direct negative impact on human health. Regardless of the results of these studies, the example sheds much light on the issue of lacking transparency; after all, toner producers are under no obligation to declare their use of nanomaterials. Moreover, the example makes it clear that a large number of employees and consumers come into contact with nanomaterials, which translates into a large number of people potentially seeking damages.

About the Authors

Tobias Widler *is the project manager and responsible for nano monitoring at the Innovation Society in St. Gallen, Switzerland. He can be reached at tobias.widler@innovationsgesellschaft.ch.*

Christoph Meili *is an expert in risk management for emerging technologies and CEO of the Innovation Society in St. Gallen, Switzerland. He can be reached at christoph.meili@innovationsgesellschaft.ch*

Richard Wieczorek *is the divisional manager of Gen Re for Germany, Austria and Switzerland and is based in Cologne. He can be reached at richard.wieczorek@genre.com.*

General Reinsurance AG
Theodor-Heuss-Ring 11
50668 Cologne
Tel. +49 221 9738 0
Fax +49 221 9738 494