

# Risks and nanotechnology: the public is more concerned than experts and industry

*To the Editor* — The public perception of nanotechnology will have a major influence on the success of new applications of nanotechnology, as will the results of risk assessments carried out by industry on these applications<sup>1–3</sup>. Here, based on two surveys, we show that lay people perceive more risks associated with nanotechnology than experts and, moreover, that companies may not sufficiently address public concerns, even though the importance of implementing risk assessment procedures during the early stages of technology development is well known.

To test whether lay people and experts differ with respect to risks associated with nanotechnology, we asked a quota sample of lay people ( $n=375$ ; German-speaking part of Switzerland) and a convenience sample of experts working in the domain of nanotechnology ( $n=46$ ) to assess the risks (1=very low; 5=very high) of 20 nanotechnology applications (see Table 1), which were described in short scenarios.

The results show that lay people's perceptions of the risks associated with nanotechnology (mean=2.64; s.d.=0.77; 95% confidence interval 2.56–2.73) were significantly higher than the experts' perceptions of the risks (mean=1.97; s.d.=0.71; 95% confidence interval 1.74–2.19). Based on the way they perceive risks, experts might not be inclined to initiate the risk assessments that are expected by the public<sup>4</sup>.

To investigate how industry approaches risk assessment, in a second survey we sent a questionnaire to 138 companies in Switzerland or Germany that produce or apply nanomaterials; data were collected between December 2005

**Table 1** The 20 nanotechnology applications presented to 375 members of public and a convenience sample of 46 experts.

|    |  |
|----|--|
| 1  | Building blocks                                |
| 2  | Car paints                                     |
| 3  | Car tyres                                      |
| 4  | Implant coating                                |
| 5  | Surface impregnation of building material      |
| 6  | Photographic paper                             |
| 7  | Clothing                                       |
| 8  | Skis   |
| 9  | Sunscreen                                      |
| 10 | Monitors                                       |
| 11 | Data memory                                    |
| 12 | Water sterilization                            |
| 13 | Release of medications                         |
| 14 | Lightweight construction of building materials |
| 15 | Ammunition                                     |
| 16 | Storage of hydrogen as a gasoline substitute   |
| 17 | Food packagings                                |
| 18 | Biosensors                                     |
| 19 | Cancer treatment with nanocapsules             |
| 20 | Medical nanorobots                             |

and February 2006. In the questionnaire we defined “nanoparticulate material” as material with one or more dimensions  $\leq 100$  nm. Forty companies (29.6% response rate) returned completed questionnaires.

In response to the question, “Does your company conduct risk assessments where nanoparticulate materials are involved?”, 26 companies (65%) indicated that they perform no risk assessments, 13 companies (32.5%) performed risk assessments sometimes or always, and one company did not reply to this question. Further analyses identified no factors that could explain when a company would

conduct a risk assessment and when it would not. For example, we did not find any differences in the response patterns of companies that produced nanoparticulate material and those companies that bought such material.

Our data suggest that a substantial number of the companies have no structured approach for assessing the risks associated with nanoparticulate material. This contrasts with public concerns and may undermine public trust in the nano-industry. Lack of trust may be a key factor in explaining why the public is often hesitant to accept some new technologies<sup>5</sup>.

The importance of trust for the positive perception of new technologies suggests that a preventable event with significant negative consequences must be avoided. Such an event, indicating lack of concern for public welfare, could have a disastrous impact on trust and result in decreased acceptance of nanotechnology. Thus, the industry should promote voluntary initiatives and regulations designed to prevent unwanted side effects.

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