Ensuring the Success of Safe Nanotechnologies
(An Aerosol Perspective)

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Abstract

Nanotechnology has great potential to benefit society, including renewable energy sources, clean water production, lighter, stronger materials, and more effective medical treatments (Schmidt 2007). Yet the success of nanotechnology will depend on understanding how products it leads to might cause harm to humans and the environment, and how that harm might be avoided.

By working at the nanoscale, researchers are developing many new materials and products that behave in unconventional ways. Many of these use aerosols as precursors, or have the potential to release nanometer-scale aerosols into the environment. But these nanometer-scale particles are often designed to exhibit unique functionality, and there is uncertainty over whether they will also present unique health and safety risks. Research has already shown that nanoscale particles can be transported to areas not accessible to larger particles; that the biological activity of some particles increases with decreasing particle size; and that under some conditions, nanoparticles can interfere with biological processes at the nanoscale, such as protein folding (Oberdörster et al. 2007; Linse et al. 2007). While these studies do not necessarily mean that the risks associated with engineered nanoparticles are higher than with other aerosols, they do raise serious concerns.

If engineered nanoparticles do have the potential to cause harm in unconventional ways, new approaches need to be considered for assessing and controlling exposure. While measuring aerosol exposure in terms mass concentration (for example) may be useful for some materials, there will be cases where aerosol surface area, or possibly number concentration, provide a better indicator of risk (Maynard and Aitken 2007). And when complex nanomaterials are being handled, new techniques may be needed to examine the physical and chemical nature of released aerosol particles that might lead to toxicity (Maynard et al. 2007).

Engineered nanomaterials are diverse, and while some will present new health and safety challenges, not all will behave in unconventional ways. Yet the current state of knowledge suggests that a greater understanding is needed on what makes nanomaterials harmful, and how possible risks can be minimized, if nanotechnologies are to be developed that are as safe as possible (Maynard et al. 2006). This presents both many challenges to the scientific community, and many opportunities for innovative research.

References

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