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BRIEFING:SAFETY

Growth of nanomaterials in construction raises health and safety concerns

The increased use of engineered nanomaterials in the construction industry – particularly in exciting innovative materials and products – raises the spectre of another asbestosis crisis. Graeme Walker, Roger Ball and Alastair Gibb of the ICE health and safety expert panel report.

Nanotechnology has been revolutionising our lives over the last decade or so. It involves the creation and/or manipulation of materials at the nanometre (nm) scale to improve their characteristics – particularly strength, durability and serviceability.

Construction applications

The construction industry is no exception. Engineered nanoparticles can now be found in a wide range of construction materials and products, usually embedded in a base material, and new applications are appearing almost monthly.

Examples include self-healing concrete, high-strength composites, corrosion-resistant reinforcement, high-strength bolts, fire protection, solar panels, water filters, aerogel insulation, ceramics, anti-rust sprays, stone and timber protection sprays, sealants, special mortars, and self-cleaning glass.

However, when such materials are subject to activities such as cutting, drilling or abrasion – or, in the case of fluids, spraying – the nanoparticles may be freed and ingested by people. As the construction industry is well aware, not all construction dust is benign.

Potential health risks

Several research projects have investigated the short- and long-term health and environmental implications of nanoparticles.

A report by the Royal Society of Chemistry in 2011 stated that though there have been few studies of the long-term consequences of nanoparticles on human health, questions have been raised of whether seemingly innocuous nanoparticle-containing materials should be treated with the same caution

Carbon nanotubes are currently used in epoxy resins to make high strength composites and paints, but are they safe? (courtesy daniel700 / Fotolia)

afforded known carcinogens such as asbestos (Sharifi *et al.*, 2012).

Indeed, a major study published in *Nature Nanotechnology* (Poland *et al.*, 2008) suggests some forms of nanoparticles could be as harmful as asbestos if inhaled in sufficient quantities. Co-author Anthony Seaton of the Institute of Occupational Medicine in Edinburgh said, 'We know that some of them probably have the potential to cause mesothelioma...so those sorts of materials need to be handled very carefully.'

Precautionary approach

The UK Health and Safety Executive (HSE) publication HSG272, *Using nanomaterials at work*, states that, 'in view of the evidence for lung damage and lack of information on the effects of long-term repeated exposure, a higher level of control is warranted' (HSE, 2013: p. 5).

While there are currently no UK statutory workplace exposure limits specifically for nanomaterials, the HSE recommends that a precautionary approach should be taken to risk management.

Applying the precautionary principle is essentially a matter of making assumptions about consequences and likelihoods to establish credible scenarios, and then using standard procedures of

risk assessment and management to inform decisions on how to address the hazard or threat.

Advice for civil engineers

In order to demonstrate best practice and prudence, all professional civil engineers should therefore carry out a control of substances hazardous to health (COSHH) risk assessment on construction products and materials believed to contain nanomaterials.

A list should be made of the actions taken to control the risks to health, including steps taken to identify the risk, how that possible risk to health is being controlled and how this will be reviewed.

A suitable COSHH assessment form is available on the HSE nanotechnology website at <http://www.hse.gov.uk/nanotechnology/index.htm>.

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