Nanotechnology: Very Little Things That May Cause Really Big Problems

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Nanotechnology in Aviation—Technological Breakthroughs and Litigation Risks

Nanotechnology may be the biggest little thing that will shape technological breakthroughs this century, but it is a concept that is still largely unknown to the average American. The use of nanotechnologies has exploded over the past decade—promising to reshape aviation and many other industries as we currently know them. However, the risks involved with the creation and wide dissemination of these new materials are also unknown.

This article will briefly discuss what nanotechnology is and how it may reshape the aviation industry. It will then turn to the potential health and safety risks that nanotechnology may present, the litigation that will inevitably result, and recap how the insurance industry is preparing for these yet unknown risks.

What is nanotechnology?

Nanotechnology will be a one trillion dollar industry by 2015, and will change the way we manipulate matter in the same way the computer science revolution has changed how we manipulate data.[1] But what exactly is this new technology? Nanotechnology is the science of moving materials on an atomic or molecular scale to build microscopic devices.[2] These materials are measured in billionths of a meter.[3] To put this into perspective, a tennis ball has a diameter of about 65,000,000 nanometers; a typical ant is about 5,000,000 nanometers long; a

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[1] Nanotechnology for Aerospace Applications: The Potential, *available at* http://www.nasc.com/nanometa/Plenary%20Talk%20Chong.pdf; *The Dawn of the Age of Nanotorts*, American Bar Association, Mass Torts, March 2009.
[2] CONVERSATIONS WITH CARL SAGAN, Introduction XV (Tom Head ed., Univ. Press of Miss. 2006).
[3] *Id.*

single human hair is about 80,000 nanometers thick; a single strand of DNA is approximately two to 12 nanometers wide; and a single-walled carbon nanotube is just 1.2 nanometers.[4]

The ability simply to make smaller machines and devices is not the most exciting aspect of nanotechnology. Many common materials actually change their inherent chemical and physical properties when reduced to nanoscale sizes, as classical physics give way to quantum effects.[5] For example, brittle silica becomes "as ductile as gold at the nanoscale," silver becomes an anti-germ agent, and gold becomes magnetic.[6]

These newly discovered properties present an almost endless variety of potential applications in industries ranging from medicine and cosmetics, to agriculture, computers, and transportation. But nanotechnology has more than just theoretical applications—there are already more than 800 consumer products that rely on nanomaterials and nanoprocesses, including computer processors, tennis racquets, stain-resistant, odor-resistant and wrinkle free clothing, antibiotic bandages, cosmetics, and sunscreens.[7]

Applications in the aviation industry

The aviation industry is always looking for lighter, faster, and more reliable technologies. Since the advent of flight, aircraft have transitioned from wood and fabric, to aluminum, fiberglass, and titanium. Today, nanotechnologies have already begun to appear in next-generation aircraft.[8] For example, the Boeing 787 "Dreamliner" utilizes carbon thermoset

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[4] Monica, Nanotechnology Law § 1:1
[5] IADC Committee Newsletter, Nanotechnology Litigation: Factors to Consider When Advising Your Clients, May 2009.
[6] *Id.*; Monica, Nanotechnology Law § 1:3
[7] *Why Growth in Nanotechnology Matters to Insurers*, Law360, Sept. 9, 2013, *available at* www.law360.com/articles/470407
[8] Nanotechnology for Aerospace Applications: The Potential, *available at* http://www.nasc.com/nanometa/Plenary%20Talk%20Chong.pdf

composites for fifty percent of its primary structure.[9] It also features windows straight out of a science fiction novel—electrochromic shades that darken or lighten in response to electricity.[10] NASA is looking into using these same electrochromics to manage the thermal environment in the newly developed Orion and Altair space vehicles.[11] These materials are lighter and better performing than previous generations of materials, which reduces the overall weight of aircraft and its overall operating costs.[12] The next iterations of nano-tech carbon bodies may be even lighter, stronger, and exhibit electrical properties such as naturally dissipating air-to-aircraft lightning strikes.[13]

Across the Atlantic, EasyJet Airlines has incorporated military-designed nanotechnology paint into its fleet of aircraft.[14] The paint reduces drag by smoothing out microscopic imperfections on the exterior of the plane—reducing fuel consumption by two percent while only adding four ounces of weight to the aircraft.[15] As fuel is the second largest cost to airlines (behind airplane acquisition), even a modest reduction in fuel consumption could make the difference between a profitable year and operating at a loss.[16]

As technological advances continue, the aerospace industry will continue to adopt nanotech components into cutting-edge aircraft. By integrating nanomaterials into more aircraft

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[9] *Id.*
[10] Flynn, David (October 26, 2011). "Light fantastic: Boeing 787 Dreamliner's digital window tinting," AUSTRALIAN BUSINESS TRAVELER, January 27, 2013
[11] Johnson, Ryan, Overview of NASA's Thermal Control System Development for Exploration Project, 2010.
[12] *Id.*
[13] *Id.*
[14] *Easyjet paint job makes fuel bill a bit less of a drag*, BBC News, Jan. 13, 2011, *available at* http://www.bbc.co.uk/news/business-12428667
[15] *Id.*
[16] Nanotechnology for Aerospace Applications: The Potential, *available at* http://www.nasc.com/nanometa/Plenary%20Talk%20Chong.pdf (Showing that fuel makes up 23 percent of the cost of owning a commercial aircraft).

components, it may be possible to create aircraft wings that can respond to changes in pressure or temperature, or bend and shape themselves ("morphing") without the use of hydraulics.[17] Besides the dramatic effect that this could have on reducing an aircraft's weight, it could also increase performance. Existing control systems intentionally restrict the operational envelope of modern high-performance aircraft to prevent them from entering a post-stall environment during dynamic maneuvering.[18] Morphing aerial structures capable of changing shape in real time could control air-flow predictably and avoid the aerodynamic destabilization of control surfaces over a greatly expanded range of flight conditions.[19] With these new technologies, aircraft may look and fly much differently than they do today.[20]

The potential for health risks

As nanotechnologies are so new, there are more questions than answers about their potential to cause health or environmental damage. However, it is clear that the extremely small size of nanomaterials will allow them to interact with the human body in ways that macro-materials cannot. At the nanoscale, there are three possible human exposure routes: inhalation, ingestion, and dermal penetration.[21] Researchers have demonstrated that once in the body, some nanomaterials even have the ability to cross the blood-brain barrier—a potentially useful

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[17] *Nanotechnology Shapes New Future for Aerospace Materials*, Airforce-Technology.com, July 28, 2010, *available at* http://www.airforce-technology.com/features/feature91197.
[18] *Id.*
[19] *Id.*
[20] *See, for example,* NASA's Twist Wing Jet: http://www.nasa.gov/missions/research/twist_wing.html.
[21] Monica, Nanotechnology Law § 7:47

characteristic for medical advances, but potentially dangerous if unintended materials collect in or interact with the brain.[22]

A 2008 study by the National Institute of Health that exposed mice to airborn carbon nanotubes caused the mice to develop a precursor to mesothelioma, prompting fears that the material may be the "next asbestos."[23] Another study showed that low concentrations of carbon nanoparticles had acute effects on cells lining renal tubules—a critical structure in the kidneys.[24] The results of the test indicate that carbon nanoparticles impact renal cells at concentrations lower than previously known and suggested caution with regard to allowing carbon nanoparticles into the food chain.[25] Other potential health hazards include: inflammation and damage to lung cells and tissues, e.g. carbon nanotubes and nanofibers may be capable of causing pulmonary inflammation and fibrosis; nanoscale titanium dioxide (TiO_2) (used in paper, paint, cosmetics, and food) should be considered a potential occupational carcinogen; and certain nanoparticles may penetrate cell membrane and may cause damage to intracellular structures and cellular functions.[26]

The greatest potential danger may be to industrial employees who have already been (and continue to be) exposed to nanomaterials in the workplace, as government regulations lag behind the new technology. The United States Department of Labor's Occupational Safety and

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[22] David Biello, *Do Nanoparticles in Food Pose a Health Risk?: A New Study Reveals that Nanoparticles are being used in Everything from Beer to Baby Drinks Despite a Lack of Safety Information*, Scientific American, March 12, 2008.
[23] *Effects of Nanotubes May Lead to Cancer, Study Says*, WASHINGTON POST, May 21, 2008; Nanotechnology *Project*, http://nano.foe.org.au/node/231
[24] Blazer-Yost BL, A Banga, et. al, *Effect of carbon nanoparticles on renal epithelial cell structure, barrier function and protein expression*, NANOTOXICOLOGY (2011).
[25] *Id.*
[26] Occupational Safety and Health Administration Fact Sheet 3634 (April 2013), accessed at https://www.osha.gov/Punlications/OSHA_FS-3634.pdf.

Health Administration ("OSHA") has released informal recommendations for limiting exposure to airborne carbon nanotubes, and has recognized that mandatory Permissible Exposure Limits ("PEL") for conventional materials may not provide adequate protection from these new materials. (*See* OSHA Fact Sheet 3634: *Working Safely with Nanomaterials*, attached) However, OSHA has yet to set a mandatory PEL for exposure to any form of nanomaterial.[27] While there have yet been no workplace injuries directly linked to nanomaterial exposure, the long term effects remain to be seen.

At this point, it is simply unclear whether nanotechnologies will cause harmful consequences or if the risk is only illusory.[28] At the same time, the U.S. government is racing to catch up. The 2014 budget for the National Nanotechnology Initiative—a federal research and development group consisting of 27 federal departments and agency groups—is $1.7 billion.[29] Despite the increased attention and funding, the timeframe for discovering and reacting to potential risks is still uncertain. In a report questioning the U.S. Consumer Product Safety Commission's ability to deal with new nano-products, the Project on Emerging Nanotechnologies noted, "[i]t took decades of research before lawmakers found the political will to keep lead and phthalates out of toys. It could take a very long time to research and ensure that potentially dangerous nanomaterials are kept out [of markets] too."[30]

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[27] *Why Growth in Nanotechnology Matters to Insurers*, Law360, Sept. 9, 2013, *available at* www.law360.com/articles/470407
[28] *The Dawn of the Age of Nanotorts*, American Bar Association, Mass Torts, March 2009.
[29] National Nanotechnology Initiative, Frequently Asked Questions, http://www.nano.gov/nanotech-101/nanotechnology-facts
[30] *Consumer Product Safety Commission Not Ready for Nanotech*, The Project on Emerging Technologies, http://www.nanotechproject.org/news/archive/cpsc/

Litigation and the insurance industry

To date, there has been little litigation surrounding nanotechnology. However, if traditional principles of tort law are used to frame and resolve disputes involving nanotechnology, consumer or other "no-injury" class actions are likely to emerge in the coming years.[31] Given the lack of research on this new technology, the potential risk to insurers is "sizable and nearly impossible to calculate."[32] The task of identifying these risks is further complicated by the fact that scientists are still discovering how nanoparticles perform in products and how they react with humans and the environment.[33]

No matter what sort of risk nanotechnologies prove to produce in the long term, litigation remains a virtual certainty.[34] Although commentators speculate that nanotorts may follow public nuisance or the toxic tort cases, nanotech case law currently remains in its infancy.[35] The high level of scientific uncertainty surrounding nanotech risk makes it nearly impossible for a plaintiff to meet the burden of proof of causation.[36]

Noting this, the insurance industry has taken a variety of steps to get ahead of the potential risks. In 2008, one major insurance carrier issued the first nano-specific commercial insurance exclusion in the U.S.[37] Comparing the potential risk to that of asbestos, the carrier

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[31] J. Philip Calabrese, Stephanie E. Niehaus, *Nano-Torts on the Horizon: A Jack and Jill Story*, 9 NANOTECHNOLOGY L. & BUS. 156 (2012).
[32] R. Blaunstein, *Unfamiliar Exposure*, Insurance Networking News (2006), *available at* http://www.insurancenetworking.com/issues/20061101/4372-1.html.
[33] Podcast, Managing the Emerging Risks of Nanotechnology, http://www.zoomerang.com/Survey/WEB229BHQJATHG (last visited Sept. 9, 2013).
[34] *The Dawn of the Age of Nanotorts*, American Bar Association, Mass Torts, March 2009.
[35] Taryn L. Rucinski, Searching for the Nano-Needle in A Green Haystack: Researching the Environmental, Health, and Safety Ramifications of Nanotechnology, 30 PACE ENVTL. L. REV. 397, 406 (2013).
[36] *The Dawn of the Age of Nanotorts*, American Bar Association, Mass Torts, March 2009.
[37] Monica, Nanotechnology Law § 7:39

explained that "the intent of this exclusion is to remove coverage for the, as of yet, unknown and unknowable risks [of nanotechnology]. The exclusion is being added to make you and your customers explicitly aware of our intent not to cover injury and/or damage arising from [nanotechnology] ..."[38]

Other insurance companies have discussed mitigating the unknown risks by excluding coverage for nanotechnology businesses entirely, excluding and writing back with limited cover, or only accepting claims within a fixed period.[39] Outside of changing policy language, others have called for standardized warning labels on of all manufactured nanoparticles and products which use or incorporate manufactured nanoparticles, "except where the nanoparticulate component of the product is intimately bound and could not be released under reasonable and foreseeable conditions of use or disposal."[40] To date, no such industry-wide standards are in place.

Overall, the use of nanotechnologies is rapidly expanding and has the potential to reshape the world that we live in. But just as many of the technologies remain undiscovered, so do the potential health and safety risks. It is prudent to discuss the use of nanotechnologies with your clients to stay ahead of any potential exposure risks.

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[38] NANOLAWREPORT, First Commercial Insurance Exclusion for Nanotechnology, http://www.nanolawreport.com/2008/09/articles/first-commercial-insurance-exclusion-for-nanotechnology/ (last visited Sept. 9, 2013).

[39] D. Baxter, LLOYD'S OF LONDON, NANOTECHNOLOGY: AN INSURER'S PERSPECTIVE, EMERGING RISKS (2008), *available at* http://www.safenano.org/Uploads/Features/SAFENANO_NanotechnologyInsurance.pdf.

[40] *Guidance on the labeling of manufactured nanoparticles and products containing manufactured nanoparticles*, PAS 130:2007, 5 (BSI British Standards 2007).

OSHA® FactSheet

Working Safely with Nanomaterials

Workers who use nanotechnology in research or production processes may be exposed to nanomaterials through inhalation, skin contact, or ingestion. This fact sheet provides basic information to workers and employers on the most current understanding of potential hazards associated with this rapidly-developing technology and highlights measures to control exposure to nanomaterials in the workplace.

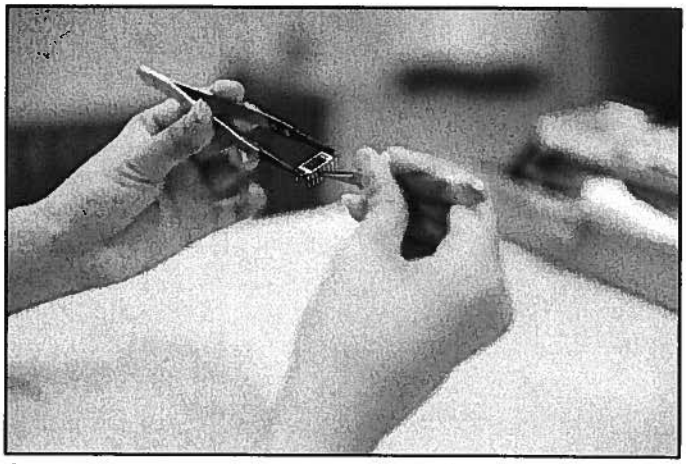
What are Nanotechnology and Nanomaterials?

Nanotechnology is "the understanding and control of matter at the nanoscale, at dimensions between approximately 1 and 100 nanometers (nm)" (www.nano.gov). A nanometer is one billionth of a meter, which is near-atomic scale. Engineered nanomaterials are assembled from nanoscale structures such as carbon nanotubes and filaments or from nanoparticles of materials such as titanium dioxide or cadmium selenide. Nanomaterials can have unique physical, chemical and biological properties that can enable their use in novel applications, such as making stain-free textiles using nanoscale additives or surface treatments or targeting drugs selectively to cancerous cells. The continued development of unique nanoscale structures has the potential to impact many industries, including electronics, healthcare, construction and consumer products.

As nanotechnology applications move from research laboratories to industrial and commercial settings, workers and employers should be aware of potential hazards posed by nanomaterials in their workplaces and employers should take appropriate measures to control worker exposure. This fact sheet reflects the current understanding of the health and safety issues relating to nanomaterials. Up-to-date information regarding this rapidly developing field of knowledge is available at www.nano.gov or at the Nanotechnology page on OSHA's website (www.osha.gov/dsg/nanotechnology/nanotechnology.html).

Nanomaterials in the Workplace

Some examples of workplaces that may use nanomaterials include chemical or pharmaceutical laboratories or plants, manufacturing facilities, medical offices or hospitals, and construction sites. One way for workers to determine if their workplace is using nanomaterials is to ask their employer.

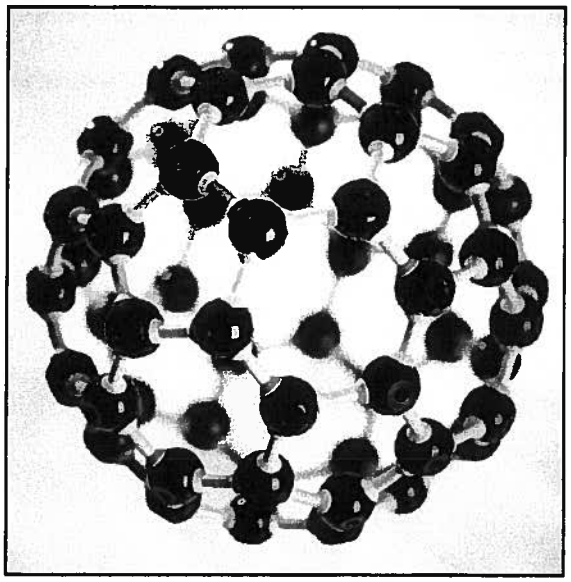


Semiconductor nanochip test package in a university nanotechnology laboratory.

Employers should check with manufacturers of chemicals and materials used in their workplace to determine if unbound engineered nanomaterials are present. The potential for nanomaterials to pose health or safety hazards is greater if the nanomaterials are easily dispersed (such as in powders, sprays, or droplets) or are not isolated or contained.

In workplaces where workers will be exposed to nanomaterials, the employer should provide information and training to their workers. This information and training should include at least the following:

- Identification of nanomaterials the employer uses and the processes in which they are used;
- Results from any exposure assessments conducted at the work site;
- Identification of engineering and administrative controls and personal protective equipment (PPE) to reduce exposure to nanomaterials;
- The use and limitations of PPE; and
- Emergency measures to take in the event of a nanomaterial spill or release.



An example of a nanoparticle is a buckyball or fullerene.

What We Know About Exposure to Nanomaterials

Information from research and animal studies on nanomaterials has identified some potential safety hazards and health effects.[1] Because nanotechnology is a rapidly emerging field, more information will likely become available about potential health and safety hazards associated with some nanomaterials. The health hazard potential depends on the particular nanomaterial and a person's exposure level. For example:

- Certain inhaled nanoparticles may be deposited in the respiratory tract and may cause inflammation and damage to lung cells and tissues; e.g., carbon nanotubes and nanofibers may be capable of causing pulmonary inflammation and fibrosis.[2]
- Titanium dioxide (TiO_2), which has many commercial applications (e.g., paint, paper, cosmetics, food), can be produced and used in varying particle sizes, including the nanoscale particle sizes (< 100 nm). NIOSH has determined that nanoscale TiO_2 particles have higher mass-based potency than larger particles, and that occupational exposure (by inhalation) to nanoscale TiO_2 particles should be considered a potential occupational carcinogen.[3]
- Certain nanoparticles may penetrate cell membranes and may cause damage to intracellular structures and cellular functions.[4]
- Some nanomaterials may act as chemical catalysts and produce unanticipated reactions, creating a risk of explosions and fires.[5]
- Some types of nanoparticle dusts may be combustible and require less energy to ignite than larger dust particles (for instance, sugar or wood), creating a risk of explosions and fires.[6]

Current Occupational Exposure Limits for Nanomaterials

Few occupational exposure limits exist specifically for nanomaterials. Certain nanoparticles may be more hazardous than larger particles of the same substance. Therefore, existing occupational exposure limits for a substance may not provide adequate protection from nanoparticles of that substance. However, some specific exposure limits already exist. For example:

- OSHA recommends that worker exposure to respirable carbon nanotubes and carbon nanofibers not exceed 1.0 micrograms per cubic meter ($\mu g/m^3$) as an 8-hour time-weighted average, based on the National Institute for Occupational Safety and Health (NIOSH) proposed Recommended Exposure Limit (REL).
- OSHA recommends that worker exposure to nanoscale particles of TiO_2 not exceed NIOSH's 0.3 milligrams per cubic meter (mg/m^3) REL. By contrast, NIOSH's REL for fine-sized TiO_2 (particle size greater than 100 nm) is 2.4 mg/m^3.

Because exposure limits for other nanomaterials do not exist yet, employers should minimize worker exposure by using the hazard control measures and best practices identified below and in the references noted under "Resources."

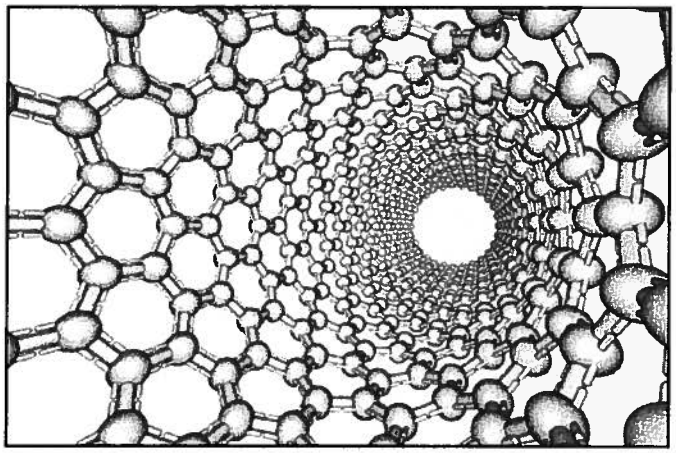
Assessing Worker Exposures to Nanomaterials

Employers should assess worker exposure to nanomaterials to identify the control measures needed and determine if the controls used are effective in reducing exposures by:

- Identifying and describing processes and job tasks where workers may be exposed to nanomaterials;
- Determining the physical state of the nanomaterials such as dust, powder, spray, or droplets;
- Determining routes of exposure (e.g., inhalation, skin contact or ingestion) of particulates, slurries, suspensions or solutions of nanomaterials;

[1] Approaches to Safe Nanotechnology: Managing the Health and Safety Concerns Associated with Engineered Nanomaterials, published by the National Institute for Occupational Safety and Health (NIOSH) in March 2009, DHHS (NIOSH) Publication No. 2009-125.
[2] See CIB 65 Occupational Exposure to Carbon Nanotubes and Nanofibers published by NIOSH in April 2013 and accessible online at: http://www.cdc.gov/niosh/docs/2013-145/.
[3] See CIB 63 – Occupational Exposure to Titanium Dioxide, published by NIOSH in April 2011 and accessible online at www.cdc.gov/niosh/docs/2011-160/pdfs/2011-160.pdf.
[4] See Approaches to Safe Nanotechnology from footnote 1.
[5] See Approaches to Safe Nanotechnology from footnote 1.
[6] See Approaches to Safe Nanotechnology from footnote 1.

- Identifying the most appropriate sampling method to determine the quantities, airborne concentrations, durations, and frequencies of worker exposures to nanomaterials[7]; and
- Determining what additional controls may be needed based on the exposure assessment results and evaluating the effectiveness of controls already in place. Employers should adopt the most effective controls available to limit worker exposure.



Model of carbon nanotubes, widely used in nanotechnology, electronics and optics.

Methods Employers Can Use to Reduce Worker Exposure to Nanomaterials

Because the research and use of nanomaterials continues to expand and information about potential health effects and exposure limits for these nanomaterials is still being developed, employers should use a combination of the following measures and best practices to control potential exposures:

Engineering Controls

- Work with nanomaterials in ventilated enclosures[8] (e.g., glove box, laboratory hood, process chamber) equipped with high-efficiency particulate air (HEPA[9]) filters.
- Where operations cannot be enclosed, provide local exhaust ventilation (e.g., capture hood, enclosing hood) equipped with HEPA filters and designed to capture the contaminant at the point of generation or release.

Administrative Controls

- Provide handwashing facilities and information that encourages the use of good hygiene practices.
- Establish procedures to address cleanup of nanomaterial spills and decontamination of surfaces to minimize worker exposure. For example, prohibit dry sweeping or use of compressed air for cleanup of dusts containing nanomaterials, use wet wiping and vacuum cleaners equipped with HEPA filters.

Personal Protective Equipment (PPE)

- Provide workers with appropriate personal protective equipment such as respirators,[10] gloves and protective clothing.

Medical Screening and Surveillance

- Make available medical screening and surveillance for workers exposed to nanomaterials if appropriate.[11]
- Review medical surveillance requirements under OSHA standards (e.g., Cadmium, Respiratory Protection).

OSHA Standards that May Apply to Nanomaterial Hazards

Nanomaterial use may fall under either OSHA General Industry or Construction standards. OSHA's Nanotechnology Safety and Health Topics Page highlights some of the OSHA standards that may apply to situations where workers handle or are exposed to nanomaterials. The General Duty Clause, Section 5(a)(1) of the *Occupational Safety and Health Act,* also may apply in situations where workers handle or are exposed to nanomaterials.

States with OSHA-approved state plans may have additional standards that apply to nanotechnology.

How OSHA Can Help Employers/Workers

OSHA offers free compliance assistance to employers and workers.

OSHA has compliance assistance specialists throughout the nation located in most OSHA offices. Compliance assistance specialists can

[7] One sampling protocol available is the Nanoparticle Emission Assessment Technique (NEAT) that NIOSH developed to qualitatively determine the release of engineered nano-materials in the workplace (see the appendix of Approaches to Safe Nanotechnology from footnote 1). See also Working Safely with Engineered Nanomaterials and Nanoproducts (www.nanowerk.com/news2/newsid=26583.php).

[8] See the Ventilation page (www.osha.gov/SLTC/ventilation/index.html) under Safety and Health Topics on OSHA's website for more information about ventilation standards and principles.

[9] High-efficiency particulate air (HEPA) filter means a filter capable of trapping and retaining at least 99.97 percent of 0.3 micrometer diameter mono-dispersed particles. NIOSH research suggests that such a filter media may effectively remove nanoparticles, see Safe Approaches to Nanotechnology from footnote 1.

[10] At a minimum, use HEPA filter equipped air-purifying respirators as specified by 29 CFR 1910.134; the equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters; see also Respiratory Protection for Workers Handling Engineered Nanoparticles, published on the NIOSH Science Blog on Dec. 7, 2011, and accessible online at http://blogs.cdc.gov/niosh-science-blog/2011/12/resp-nano.

[11] CIB 60 – Interim Guidance for Medical Screening and Hazard Surveillance for Workers Potentially Exposed to Engineered Nanoparticles, published by NIOSH in February 2009 and accessible online at www.cdc.gov/niosh/docs/2009-116pdfs/2009-116.pdf.

provide information to employers and workers about OSHA standards and short educational programs on specific hazards. For more information, visit OSHA's website or call 1-800 321-OSHA (6742) to contact your local OSHA office.

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on controlling hazards and complying with OSHA standards, and assist in establishing safety and health management programs. To find the On-site Consultation office nearest you, visit www.osha.gov/consultation or call 1-800-321-OSHA (6742).

Resources for Additional Nanotechnology Information

OSHA's Nanotechnology Safety and Health Topics Page provides information from a variety of other agencies and organizations.

What Rights Do Workers Have?

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- File a confidential complaint with OSHA to have their workplace inspected.
- Receive information and training about hazards, methods to prevent harm, and the OSHA standards that apply to their workplace. The training must be done in a language and vocabulary workers can understand.
- Call OSHA for free information or to ask questions.
- Receive copies of records of work-related injuries and illnesses that occur in their workplace.
- Receive copies of the results from tests and monitoring done to find and measure hazards in their workplace.
- Exercise their rights to a safe and healthful workplace without retaliation or discrimination.