

07-OH-01

Committee: Occupational/Environmental

Title: OCCUPATIONAL AND ENVIRONMENTAL RISKS OF NANOTECHNOLOGY

Statement of the Problem:

In general terms, nanotechnology covers “engineered structures, devices and systems that have a length scale of 1 – 100 nanometers. At these length scales, materials begin to exhibit unique properties that affect physical, chemical and biological behavior.” (1) Nanotechnology is already used for a wide variety of products such as paints, sunscreen and cosmetics, sports equipment, stain-free clothing and automobile parts and equipment. Currently, over 200 products are on the market. (2)

By 2015, the economic impact of nanotechnology world-wide is expected to be over \$1 trillion. (1) Research and development is particularly significant in the fields of electronics, optoelectronics, magnetic applications, medical imaging, drug delivery, and cosmetics. The National Nanotechnology Initiative, the federal government’s coordinating body for nanotechnology R & D, has spent approximately \$1 billion per year since 2001. (3) Only about 4% of that amount has been dedicated to studying the potential health and environmental effects of nanomaterials in the last 3 years. (3) This seems inadequate given that an estimated 2 million workers are exposed to nanometer particles on a regular basis. Researchers and other interested parties have recommended that federal funding be greatly increased. Annual funding for the EPA’s Particulate Matter Research Program was authorized at approximately \$100 million.

The health, safety and environmental effects of nanomaterials are poorly understood. The size, surface area, reactivity and other unique characteristics of such substances raise concern that their effects on biological systems may be different than the effects posed by their conventional counterparts. Recent research suggests that nano-sized materials can penetrate deep into the lungs (4), reach the brain via the olfactory nerves (5), penetrate the skin (6), and cause oxidative damage (7). Studies on fish suggest that at least one form of nanoparticles can cause significant damage to the brain (7). Another concern is the potential explosiveness of nanomaterials. The potential for dusts of many chemicals to explode is well known, and particle size and surface area play a role in their explosiveness, yet no studies have been published examining this hazard for nanoparticles.

There are many uncertainties regarding the health, safety and environmental effects of nanotechnology; however, our limited knowledge of its potential harm is cause for concern. The Royal Society of Great Britain, among others, has therefore called for the application of the “precautionary principle” (8): taking measures to prevent harm even when threats to human health or the environment are not fully established. Several government agencies and organizations are in the process of establishing guidelines for the control of nanotechnology, including the National Institute for Occupational Safety and Health, the U.S. Environmental Protection Agency, ASTM International and the International Standards Organization. However, enforceable standards have not been promulgated to protect workers, the general public or the environment.

REFERENCES

1. National Institute for Occupational Safety and Health, “NIOSH Safety and Health Topic: Nanotechnology (Background)”, <http://www.cdc.gov/niosh/topics/nanotech/background.html> (accessed 2/5/07)

2. Woodrow Wilson International Center for Scholars (2006). A nanotechnology consumer product inventory. Project on Emerging Nanotechnologies. <http://www.nanotechproject.org/index.php?id=44> (accessed 2/5/07).
3. U.S Office of Science & Technology Policy. The National Nanotechnology Initiative – Research and Development Leading to a Revolution in Technology and Industry. Supplement to the President's FY2007 Budget. http://www.nano.gov/NNI_07Budget.pdf (accessed 2/5/07).
4. Lam C. The pulmonary toxicology of single-walled carbon nanotubes. Toxicol. Sci 2004; 77:126-134.
5. Oberdorster G, Sharp Z, Atudorei V, Elder A, Celia R, Kreyling W, Cox C. Translocation of inhaled ultrafine particles to the brain. Inhalation Toxicol.2004; 16:437-445.
6. National Institute for Occupational Safety and Health, "NIOSH Safety and Health Topic: Nanotechnology (Occupational Health Risks)", <http://www.cdc.gov/niosh/topics/nanotech/ohrisks.html> (accessed 2/6/07).
7. Oberdorster E. Manufactured nanomaterials (fullerenes, C60) induce oxidative stress in the brain of juvenile largemouth bass. Environmental Health Perspectives 2004; 112(10):1058-1062.
8. Royal Society. Nanoscience and nanotechnologies: opportunities and uncertainties, July 29, 2004. <http://www.nanotec.org.uk/finalReport.htm> (accessed 2/6/07)

Statement of the desired action(s) to be taken:

CSTE shall request the U.S. Environmental Protection Agency to establish a national registry of companies that manufacture or use nanoparticles, and make that registry publicly available.

CSTE shall request the U.S. Environmental Protection Agency to require the submission of "Pre-manufacture Notices" by manufacturers of nanomaterials, in accordance with the Toxic Substances Control Act, and to insist on a thorough characterization of potential health and environmental risks of these materials.

CSTE shall request Congress and the appropriate federal agencies to significantly increase the level of funding for research on the health, safety and environmental impacts of nanotechnology.

CSTE shall request the U.S. Food and Drug Administration to require the labeling of cosmetics that contain nanoparticles, listing the contents, intended use and proper handling of the product.

CSTE shall request the Occupational Safety and Health Administration and the Environmental Protection Agency to promulgate standards for the protection of workers, the general public and the environment.

Public Health Impact:

Increased availability of information to the public on the uses of nanotechnology;
Identification of the producers and industrial users of nanomaterials;
Increased funds to support a necessary research program on the health and environmental impacts of nanotechnology;

Increased government oversight of the nanotechnology industry;
Increased understanding of the health, safety and environmental effects of nanoparticles;
Increased protection of workers, consumers, the general public and the environment from the adverse effects of nanotechnology.

Agencies for Response:

- (1) Stephen Johnson
Administrator
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460
Telephone Number 202-564-4700
johnson.stephen@epa.gov

- (2) Edwin Foulke, Jr.
Title Assistant Secretary of Labor
Occupational Safety & Health Administration
200 Constitution Avenue, NW
Washington, DC 20210
Telephone Number 202-693-1999

- (3) Andrew von Eschenbach, M.D
Title Commissioner
5600 Fishers Lane
Rockville MD 20857
Telephone Number 301-827-2410
andrew.voneschenbach@fda.hhs.gov

Agencies for Information:

- (1) Jennifer Sass, Ph.D.
Staff Scientist
Natural Resources Defense Council
40 West 20th Street
New York, NY 10011
Telephone Number (212) 727-2700
jsass@nrdc.org

- (2) John Howard, M.D., M.P.H., J.D., LL.M.
Title Director
National Institute for Occupational Safety and Health
Hubert H. Humphrey Bldg, Room 715H
200 Independence Ave., SW
Washington, DC 20201
Telephone Number (202) 401-6997

- (3) Georges C. Benjamin, MD, FACP
Executive Director
American Public Health Association
800 I Street, NW
Washington, DC 20001
Telephone Number 202-777-2742

georges.benjamin@apha.org

Submitting Author:

- (1) Richard Rabin
Coordinator, Lead Registry
Massachusetts Department of Labor
1001 Watertown St.
Newton, MA 02465
Telephone Number 617-969-7177
rick.rabin@state.ma.us

Co-Author:

(1)

Richard Kreutzer, MD
Chief
Environmental Health Investigations Branch, CA Department of Health Services
850 Marina Bay Parkway, bldg. P, 3rd floor
Richmond, CA 94804
Telephone Number 510-620-3620
RKreutze@dhs.ca.gov