ENVIRONMENT, SAFETY & HEALTH

SAFETY & HEALTH BULLETIN

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Good Practices For Handling Nanomaterials

PURPOSE

This Bulletin provides information on a safety concern that may impact operations at Department of Energy (DOE) facilities. Specifically, the concern is the safe handling of nanomaterials.

BACKGROUND

Nanotechnology has been generally defined as the manipulation of matter in the length of approximately 1-100 nanometer (nm = one billionth of a meter) range to produce new materials, structures, and devices with unique properties and functions because of its small size. The growth of nanotechnology activity across the DOE complex and the lack of specific knowledge on the health risks associated with these activities raise health and safety concerns.

Nanomaterials can be found in use and development in areas as diverse as fundamental research, consumer products, medical, and environmental fields. They come in a variety of shapes and sizes, such as "buckyballs," fibers, and "dots."

WHAT IS DIFFERENT ABOUT NANOMATERIALS?

The properties of particles at the nanoscale are not necessarily the same as those of the same material at a large scale. The physical characteristics that make nanomaterials useful could result in unknown environmental and health concerns due to their size, large surface area, and high reactivity. Nanomaterials may interact with the human body in different ways than conventional materials due to their extremely small size.

ACTIVITIES WITHIN DOE

Research activity has been ongoing for a decade and currently there are approximately 150-200 grants for nanotech-related work on laboratory scale split between University and DOE laboratories, as well as work for others. DOE is currently developing five new Nanocenters to undertake research in this field. The Office of Environment, Safety and Health is currently developing a Secretarial Policy on Nanotechnology.

PROPOSED LABORATORY SAFETY GUIDELINES FOR HANDLING NANOMATERIALS

- Evaluate safety and health risks on a case-by-case basis; no blanket recommendation can be made.
- Consider the hazards of precursor and waste materials in evaluating process hazards.
- Consideration should be given to the high reactivity of some nanomaterials with regard to potential fire and explosion hazards.
- Use fume exhaust hoods to expel fumes from tube furnaces or chemical reaction vessels.
- Use tested HEPA-filtered ventilation systems and vacuum cleaners to clean up nanomaterials.
- Equipment used to handle nanomaterials should be evaluated for potential contamination prior to repair, reuse, or disposal.
- Dispose of and transport waste nanomaterials according to hazardous chemical waste guidelines.

PERSONAL PROTECTIVE EQUIPMENT

There is little information about the effectiveness of available personal protective equipment against exposure to nanomaterials. Until more is known about the hazards, use of the following good laboratory safety practices would be a prudent approach:

- Wear gloves, lab coats, safety glasses, and face shields as needed.
- Good hand washing and personal hygiene should be maintained around nanotechnology work areas.
- Avoid skin contact with nanomaterials or nanomaterial -containing solutions.
- Use N, P, or R100 (HEPA) particulate respirators for protection against inhalation exposure.

SUMMARY

- Nanotechnology produces particles with new properties.
- Nanomaterials do not behave like larger sizes of the same materials.
- Surface area and number of nanomaterials are important, not just the mass.
- Follow laboratory practices used for unknown hazards when handling nanomaterials.
- Properly clean or dispose of any contaminated protective equipment.

If you have any questions, please call me or Dr. Bill R. McArthur at 301-903-9674 or by e-mail at bill.mcarthur@eh.doe.gov.

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