

Nanoparticle Handling Fact Sheet

Environmental Health and Radiation Safety

Background

Although insufficient information exists to predict the health hazard posed by the exposure to nano particles, current research indicates that exposure via inhalation and skin contact can result in these particles entering the body. Results from human and animal studies show inhaled nano particles can deposit in the respiratory tract. Animal studies also show nano particles can enter the bloodstream and translocate to other organs. Nano particles have the greatest potential to enter the body if they are in the form of individual particles, agglomerates of nano particles, and particles from nanostructured materials that become airborne or come into contact with the skin.

According to [NIOSH](#) the following workplace tasks may increase the risk of exposure to nano particles:

Working with nano particles in liquid media without adequate protection (e.g., gloves) will increase the risk of skin exposure.

Working with nano particles in liquid media during pouring or mixing operations, or where a high degree of agitation is involved, will lead to an increased likelihood of inhalation and respirable droplets being formed.

Generating nano particles in the gas phase in non-enclosed systems will increase the chances of aerosol release to the workplace.

Handling nano structured powders will lead to the possibility of aerosolization.

Maintenance on equipment and processes used to produce or fabricate nano particles will pose a potential exposure risk to workers performing these tasks.

Cleaning of dust collection systems used to capture nano particles will pose a potential for both skin and inhalation exposure.

Control Procedures

While the health risks from exposure to nano particles are not known, the work practice and engineering control procedures to prevent exposure are well understood. Standard laboratory practices regarding the use of [hazardous chemicals](#) and [gases](#) must be followed. The following engineering, work practice and ventilation controls are required when handling nano particles to reduce potential exposure and ensure safe conditions in University of Pennsylvania laboratories.

Lab Protection and Hygiene

[Lab coats](#) must be worn. Lab coats must be laundered monthly via an approved laundry service or using University provided lab coat laundry services. Lab coats may not be taken to private homes and laundered.

[Arm sleeves](#) are required where high levels of exposure or splashes of solutions containing nano particles are anticipated.

Standard Penn [safety glasses](#) are required when working in any lab.

[Gloves](#) (disposable nitrile) must be worn when handling nano materials. Because skin penetration is a concern gloves must cover the wrist and any skin on the arm exposed by the lab coat.

Appropriate personal clothing is required in all laboratories including those that work with nano materials. Long pants and closed toed shoes are required.

[Respirators](#) may be required for activities that cannot be controlled using ventilation. The need for and selection of respirators is the responsibility of the Office of Environmental Health and Radiation Safety. All respirators users will comply with the University's [Respirator Protection Program](#).

Offices and general-purpose workstations may not be located inside laboratories that handle nano materials.

Hand washing facilities must be provided in all labs. Hand washing must be performed after handling nano materials.

Lab Contamination and Cleaning

Avoid lab contamination by selecting from the following control procedures:

Restrict the handling of nano particles to areas well within the lab.

Handle dry nano materials in a fume hood, biological safety cabinet, glove box or a [vented filtered enclosure](#). Do not work on the open bench with dry nano particles.

Transport dry nano particles in closed containers.

Handle solutions containing nano particles over disposable [bench covers](#).

Aerosol producing activities (such as sonication, vortexing and centrifuging) may not be conducted on the open bench. Perform these activities in a

fume hood, biological safety cabinet, glove box or a [vented filtered enclosure](#).

Clean bench tops using a [cleaning solution](#) after each work activity.

Spills of dry nano particles must be cleaned with a HEPA vacuum. Dry sweeping must not be used. Large spills must be cleaned by [EHRS](#).

Daily vacuuming of benches and floors with a HEPA vacuum should be performed in labs that handle nano particles.

Ventilation Controls

Labs that handle nano particles must have non-recirculating ventilation systems (preferably 100% exhaust air) with ventilation rates of 6-12 air changes per hour. Lab pressurization must be negative to the hallway.

Activities that are likely to release nano particles (such as the opening and emptying of reactors, borosilicate tubes, weighing of dry nano particles) shall not be performed on the open bench. These activities shall be performed in a fume hood (or other vented enclosure), biological safety cabinet, glove box or a [vented filtered enclosure](#).

Exhaust from all furnaces used to produce nano particles must be trapped and connected to a local exhaust source.

Waste Disposal

All solutions and solid materials must be disposed of as hazardous waste following established [University guidelines](#).

Additional Resources

[National Institute for Occupational Safety and Health](#)
[National Nanotechnology Initiative](#)