University of Rochester Nanomaterials Safe Handling Guidelines

Purpose:

These guidelines were written to assist university personnel that may be working nanomaterials.

Scope:

This document provides general and minimal health and safety guidance to faculty, staff, students and visitors working with nanomaterials at the University of Rochester. For more detailed guidance, please read the following documents:

- NIOSH Publication ***Protecting Workers During the Handling of Nanomaterials*** (2018): *https://www.cdc.gov/niosh/docs/2018-121/default.html*
- *OSHA Fact Sheet on Working Safely with Nanomaterials*: *https://www.osha.gov/Publications/OSHA_FS-3634.html*

Guidelines:

Nanomaterials are materials with lengths in 2 or 3 dimensions between 1 and 100 nanometers. 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 are still being studied and applied to new technologies at the university.

Nanotechnology is a rapidly emerging field so 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.

There are currently no federal regulations that specifically address the health and safety implications of nanotechnology. Therefore, as with conventional chemicals, research with nanomaterials must be conducted in a conservative manner that is safe and responsible. All chemicals, including nanomaterials, must be transported, stored, used, and disposed of in accordance with all University, state and federal requirements.

The National Institute for Occupation Safety and Health (NIOSH) has established Recommended Exposure Limits (REL) as a guideline for two types of nanomaterials:

For fine Titanium dioxide: 2.4 $\mu g/m^3$

For carbon nanotubes and nanofibers: 1 $\mu g/m^3$

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Some manufacturers may set recommended exposure limits for certain products. For example, Bayer has set an Occupational Exposure Limit of 0.05 µg/m³ for Baytubes (carbon nanotubes).

Given the uncertainty as to the level of risk, UR students, staff and faculty must take a precautionary approach to working with nanoparticles to avoid possible unexpected or undesired outcomes. Consider all routes of possible exposure to nanomaterials including inhalation, ingestion, injection, and dermal absorption (including eye and mucus membranes).

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 confined. Nanomaterials must be handled as a hazardous substance in conjunction with the University of Rochester Chemical Hygiene Plan (CHP link). Departments and Principal Investigators using nanomaterials must develop and document safe work practices (SOP's) for working with nanomaterials. Please contact EH&S at 275-3241 if assistance if needed.

Controlling 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, employees and students should use a combination of the following measures and best practices to control potential exposures:

Engineering Controls:

- Work with nanomaterials in ventilated enclosures (e.g., glove box, chemical fume hood, biological safety cabinet) equipped with high-efficiency particulate air (HEPA) filters.
- Where operations cannot be enclosed, provide local exhaust ventilation (e.g. slotted exhaust, snorkel, capture hood, enclosing hood) equipped with HEPA filters and designed to capture the contaminant at the point of generation or release.

Administration:

Administrative Controls/Work Practices:

- Assess hazards of the materials you will be using (keeping in mind that there is considerable uncertainty about the toxicity of nanomaterials) and adopt prudent written laboratory practices for use of these materials.
- Train staff and students working with nanomaterials on the hazards of the material, review the safety data sheet, and review methods to minimize exposure to nanomaterials.
- Provide handwashing facilities and information that encourages the use of good hygiene practices.

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- 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
- Establish designated work areas where nanomaterials will be used.
- Wash hands before eating, smoking or leaving the work area.
- Clean work area daily using a wet wiping method or HEPA vacuum.
- Dispose of nanomaterials as hazardous waste through UR Environmental Compliance Unit (phone 275-2056)

Personal Protective Equipment: Wear eye/face protection, gloves and a lab coat or protective clothing when handling nanomaterials. Please contact EH&S at 275-3241 for assistance with choosing the correct PPE.

- For dry particulate, use standard disposable nitrile gloves.
- For solutions containing nanomaterials, choose a glove that is protective against the solvent.
- For tasks with high risk of skin contact, double glove with extended cuff gloves and use sleeves, gowns, or suits made of Tyvek or other air-tight non-woven textile.
- Consider HEPA-filtered respirators if work activities cannot be performed with a ventilated enclosure. Compliance with the UR Respiratory Protection Program http://www.safety.rochester.edu/ih/respiratoryprotection/respprogram.html) is required.

REFERENCES: Several government agencies have documented resources regarding safe handling of nanomaterials. *These references should be read by anyone planning to handle nanomaterials.

- *NIOSH Publication ***Protecting Workers During the Handling of Nanomaterials*** (2018): *https://www.cdc.gov/niosh/docs/2018-121/default.html*
- *OSHA Fact Sheet on Working Safely with Nanomaterials: *https://www.osha.gov/Publications/OSHA_FS-3634.html*
- *National Institute for Occupational Safety and Health(NIOSH) Nanotechnology page: https://www.cdc.gov/niosh/topics/nanotech/*
- *National Nanotechnology Initiative: https://www.nano.gov/node/19*
- https://www.epa.gov/chemical-research/research-nanomaterialswww.eh.doe.gov/[aa/safety_bulletin/safety_bulletin_2005-06.pdf
- NIOSH Publication **Current Strategies for Engineering Controls in Nanomaterial Production and Downstream Handling Process** (2013): *https://www.cdc.gov/niosh/docs/2014-102/pdfs/2014-102.pdf*

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