

NANOMATERIAL SAFETY

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Environmental Health & Safety
Michigan State University
4000 Collins Road, Room B20
Lansing, MI 48910
517-355-0153
ehs.msu.edu

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Purpose

At MSU, a growing number of Spartan innovators are harnessing the unique properties of nanomaterials into their research. These engineered nanomaterials, 1-100 nanometers in size, have cutting-edge applications in advanced pharmaceutical delivery, materials science, environmental remediation and a multitude of other ventures.

Their very small size makes them both promising and challenging. Nano-sized particles can enter the human body through inhalation, ingestion and through the skin. However, few occupational exposure limits exist specifically for nanomaterials—and those that do may not provide adequate protection for long term health effects.

The Office of Environmental Health & Safety has tools and information to mitigate the potential health effects and safety hazards of nanomaterials. This document provides general safety practices that will mitigate potential exposure.

If you are currently using nanomaterials, or considering their use, please complete the [Nanomaterial Safety SOP Form](https://ehs.msu.edu/lab-clinic/chem/nanomaterials.html) (<https://ehs.msu.edu/lab-clinic/chem/nanomaterials.html>) and email it to Tyler McCord at mccordty@msu.edu. You may also call 517-432-5631 with any questions or concerns.

Standard Operating Procedures

Labs using nanomaterials are required to complete Nanomaterial Safety Standard Operating Procedure documents. The template can be found on the [Nanomaterials website](https://ehs.msu.edu/lab-clinic/chem/nanomaterials.html) (<https://ehs.msu.edu/lab-clinic/chem/nanomaterials.html>). Email drafts to mccordty@msu.edu for review and approval.

Laboratory Design

- Set up a designated area for work with nanomaterials and suspensions away from entrances and high traffic areas. A designated area may be an entire laboratory, a section of a laboratory, or a containment device such as a laboratory hood or glove box.
- Post signs indicating hazards, personal protective equipment requirements, and administrative control requirements at entry points into designated areas where nanomaterials are handled.
- Handle dry nanomaterials in a fume hood, biological safety cabinet, glove box or a vented filtered enclosure. Do not work on the open bench with dry nanomaterials.
- Aerosol producing activities (such as sonication, vortexing and centrifuging) should not be conducted on the open bench. Perform these activities in a fume hood, biological safety cabinet, glove box, or a vented filtered enclosure.
- Nanomaterials should be stored in labeled containers that indicate their chemical content and form.
- Liquids or dry particles should always be stored in unbreakable, tightly sealed containers.
- Secondary containment should be used when appropriate.
- Clean areas where nanomaterials are prepared and/or administered immediately following each task and each day after work with the nanomaterials is complete.

- Daily vacuuming of benches and floors with a HEPA vacuum should be performed in labs that handle dry nanomaterials. **Only use HEPA-rated vacuums; using non-HEPA vacuums can release nanomaterials directly into the surrounding atmosphere. HEPA vacuuming is not recommended for reactive materials, as they may react with other materials collected in the vacuum, or with components of the vacuum itself.**
- Use wet wiping or HEPA vacuuming to clean large surfaces (i.e. floors, benches).
- Using wet methods, routinely clean containment device interiors, equipment, and laboratory surfaces where there is potential for nanomaterial contamination. Consider the potential for complications due to the physical and chemical properties of the material to avoid reactions with cleaning agents.

Work Practice Controls

The following practices should be observed in all labs using nanomaterials:

- When possible, acquire nanoparticles in dispersion or in bulk solids, and handle in powder form only when no other options exist.
- Do not store or consume food or drink in areas where nanomaterials are handled.
- Do not apply cosmetics in areas where nanomaterials are handled.
- Wash hands before leaving the work area and after removing protective gloves.
- Avoid touching the face or other exposed skin when working with nanomaterials.
- Change gloves regularly (at least every two hours) and wash hands at the time of the glove change.

Engineering Controls

Activities that are likely to release nanomaterials should not be performed on the open bench. This can include weighing dry materials, preparing suspensions, or cutting, sawing, drilling, and sanding bulk solids containing nanomaterials. These activities should be performed in a fume hood (or other vented enclosure), biological safety cabinet, glove box or a vented filtered enclosure.

Controls beyond those described above are warranted when aerosol generation of nanomaterials will be extensive, or will involve acutely hazardous parent materials. These controls might include a higher level of containment and/or HEPA-filtration or other cleaning of exhaust.

Personal Protective Equipment (PPE)

All workers handling nanomaterials should wear the following Personal Protective Equipment:

- Always wear long pants and closed toe shoes when working in the lab.
- Always wear disposable nitrile gloves and lab coat when handling nanomaterials, with the gloves covering the cuff of the lab coat.
- Wear face shield and goggles where splashes may occur.

- Only launder lab coats using University laundry services. Do not take lab coats to private homes.
- When ventilation controls are deemed inadequate, respirators may be needed. Respirator use should comply with MSU's [Respiratory Protection Program](https://ehs.msu.edu/occ/respirator/index.html) (<https://ehs.msu.edu/occ/respirator/index.html>).

Transport & Shipping

Complete dangerous goods declaration or shipping papers for offsite shipments of nanomaterials in accordance with the IATA and DOT regulations. Contact EHS for instruction on shipping potentially hazardous materials.

Materials sent offsite must also include a prepared document that describes known and suspected properties likely to be exhibited and notification of potential hazards. The institution may be required to create a Safety Data Sheet (SDS) for the material.

Nanomaterial Disposal

- All waste should be kept in hazardous waste containers and labeled for pickup from EHS within 90 days of waste generation.
- All equipment that contacts nanomaterials during work processes should be disposed of as hazardous waste.
- Waste should never be poured down the drain or placed in trash bins.
- Visit the EHS website to [request hazardous waste pickup](https://ehs.msu.edu/waste/completing-pickup-form.html) (<https://ehs.msu.edu/waste/completing-pickup-form.html>).

Emergency Procedures

- In the event of a spill, safety always comes first.
- Alert and clear everyone in the immediate area where the spill occurred.
- Always wear appropriate PPE when cleaning up a spill.
- If you are unable to contain the spill yourself, call EHS at 517-432-5631 for assistance.
- If you are able to clean up the spill yourself, you may visit the EHS website to request hazardous waste pickup for the cleanup materials.
- For liquid suspension spills, absorb using appropriate sorbents.
- For dry spills, clean with a HEPA vacuum or moist sorbent pads, or wet the material with an appropriate solvent and wipe with a dry cloth. **Only use HEPA-rated vacuums; using non-HEPA vacuums can release nanomaterials directly into the surrounding atmosphere. HEPA vacuuming is not recommended for reactive materials, as they may react with other materials collected in the vacuum, or with components of the vacuum itself.**
- Collect the residue, place in a container, and contact EHS for disposal at 517-355-0153.

Safety Data Sheets

Electronic or printed Safety Data Sheets for all nanomaterials should be easily accessible to lab personnel.

Training

All individuals handling nanomaterials should receive the following training, and training should be documented (topics covered, date, employee names and signatures).

Employees working with chemicals must complete the following training:

- Chemical Hygiene and Hazardous Waste Initial / Refresher
- Laboratory Safety
- Site Specific Training with PI or lab manager
- Review and signature of this completed SOP