



Lab Specific Safety Training
NNIN-Nano Research Facility and EECE-Jens Lab
2013





Lab Safety Policies

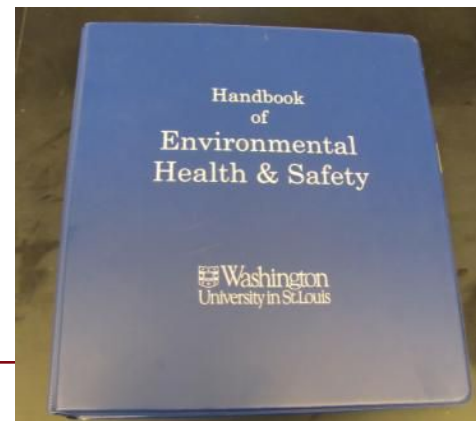
Safety for Nanomaterials

Safety Quiz



Lab Safety Training and Access

- All users must first complete the **annual safety training** offered through the **EH&S department** (<http://ehs.wustl.edu/Pages/default.aspx>). A copy of the certification must be sent to the NRF Lab Manager.
- All users must complete **laboratory specific training** prior to gaining independent access to the lab and must sign the training record in the **lab Blue Book**.





Equipment Policies

- The equipment in the NRF and Jens facilities is under the responsibility of the full time staff members. Staff members are responsible for the maintenance, training, and process development. **Users must be trained by NRF and Jens Lab staff before operating any equipment.** Staff members are available for training sessions on equipment via an online training request form on Facility Online Manager. (FOM, <http://nnin.seas.wustl.edu/fom/welcome>)
- No alterations of any kind should be done to the tools or the engineering control devices in place to ensure safe operation. If a user has trouble or notices a mechanical failure of a tool, this should be brought to **the immediate attention of NRF and Jens staff.**

Staff Contact Information

Weining Wang

Office: Brauer 3027/3035

Tel: 314-935-6018

Email:

wangwn@wustl.edu

Nathan Reed

Office: EPS L27

Tel: 314-935-7264

Email:

Sanmathi Chavalmane

Office: Brauer 010

Tel: 314-935-

Email:

Patty Wurm

Office: Brauer 009

Tel: 314-

Email:





General

- The NRF and Jens Labs are shared user facilities. **Using the facilities is a privilege and those who do not follow guidelines and work in a responsible manner may be banned from the facilities.**
- Every user is responsible for understanding the materials they are working with and handling them in a manner that minimizes their personal exposure and the exposure of others working in the lab!
- Please be considerate of others and clean up after yourself!





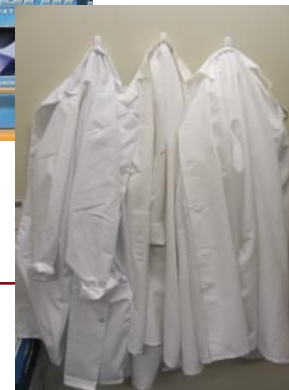
General

- No food or drink is allowed in the labs!
- Avoid working alone in a building. Do not work alone in a laboratory if the procedures being conducted are hazardous.
- If leaving an experiment or process unattended leave lights on, place an appropriate sign near the experiment with your name, time and contact information, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water).
- Remove gloves and/or wash areas of exposed skin well before exiting the laboratory. **Do NOT touch the door handle if you are wearing gloves!**



Dress Code and Personal Protective Equipment

- Acceptable dress for lab users includes **full length** skirts and pants and **closed toe shoes**.
- **Shorts and Capri pants are not allowed! Sandals are not allowed!**
- Lab coats are available for use in every lab and should be worn when handling any chemicals.
- Safety glasses are available in the labs and should be worn when working with chemicals.
- Gloves should be worn when working with chemicals. Small, medium, and large nitrile gloves are available in the labs.



source: www.google.com





Chemicals

- Any **“NEW”** chemicals stored in the lab, must first be **approved by Staff**.
- Confirm there is a **MSDS (Material Safety Data Sheet)** for the chemical(s) you wish to bring in. You are responsible for providing an MSDS if there is not a copy in the MSDS notebook.
- **All chemicals and samples** brought into the lab must be clearly labeled with **user name, chemical name, associated hazards, and the date**.
- No open containers of liquids are permitted in the storage cabinets or fume hoods.
- **Select chemical carcinogens** shall only be used in designated areas. Please discuss use of toxic and carcinogenic chemicals with a lab staff member before use.
- **Do not leave your samples or chemical solutions in the NRF and Jens labs! Samples left unattended for more than 24 hours will be thrown away.** If you require sample storage space please discuss with a lab staff member.



Avoidance of "Routine" Exposure

- **Clean up after yourself!**
- **Wash your hands** before leaving the lab!
- **Remove gloves and labcoats** before exiting the lab. **Never touch the doorhandle with dirty gloves!**
- Use a **secondary container** to transport samples and other materials to and from the lab.
- Use a **fume hood or snorkel hood** whenever possible.



Use of Fume Hood

- Use the fume hood for operations that might result in release of **toxic chemical vapors** or **dust** or when handling **nanomaterials**.
- **Keep the fume hood sash closed at all times** except when adjustments within the fume hood are being made.
- When using a horizontal sash fume hood a **glass panel should be between your face and the interior of the fume hood** with just enough clearance for your arms between panels during operations.
- When using a vertical sash fume hood the sash should be lifted only high enough to allow your arms to enter the hood (**~6" to 12"**).
- Hazardous materials should be at least **6 inches behind the sash** of the fume hood.
- **NEVER leave any liquid-filled container in a hood without a label.** Maximum time for unattended chemicals is 12 hours.

source:
www.safetyoffice.uwaterloo.ca
www.fume-hoods.us





Spills for chemicals NOT containing Nanomaterials

- Spills of **non-hazardous** materials may be cleaned with paper towels or a spill kit and placed in the trash.
- **Small spills of hazardous, non-volatile** materials may be cleaned with paper towels and/or a spill kit. Please contact a lab staff member to assist you!
- **Do NOT attempt to clean up** a spill of **volatile hazardous waste** or a **large hazardous waste spill** yourself; you could be exposing yourself to great danger!
- **Spills:** Call **University Police at 935-5555** and give them your location (building name and room number), your name, the number of the nearest safe phone to call back on and the nature of the spill - chemical, biological, or radiological. **Notify lab staff.**





Spills for chemicals Containing Nanomaterials

- **In a fume hood** small spills of nanomaterials in a liquid may be cleaned with paper towels and/or a spill kit.
- **In a fume hood** small spills of dry nanomaterials may be cleaned with **WET** paper towels or wet-wipes.
- All materials contaminated with nanomaterials should be **collected and sealed in a plastic bag** while still in the fume hood. Notify lab personnel for proper disposal, noting the type of nanomaterial, type of liquid and any equipment that may have been contaminated.
- If a spill occurs **outside a fume hood** the spill should be covered with a damp paper towel or wet-wipe then all lab users should leave the lab and **contact lab staff**. **Do NOT attempt further clean up** a spill of nanomaterials outside of a fume hood yourself!
- In the event that your lab coat or clothing is **contaminated with nanomaterials** remove the contaminated clothing and place in a large plastic bag.



Waste Disposal

- Collect all unwanted chemical waste in the appropriate waste containers (**EHS blue unwanted materials labels**). **Do NOT mix different waste types! Mixing incompatible waste types can cause explosions and fires or create toxic gases!!**
- Do NOT pour down the drain** any concentrated acids or bases; highly toxic, malodorous, or lachrymatory substances; or any substances which might interfere with the biological activity of waste water treatment plants, create fire or explosion hazards, cause structural damage or obstruct flow. For all drain disposal questions, contact lab personnel or the **EHS office at (314) 362-6816**.
- The only chemicals that may be safely washed down the drain are pure water and any solutions made with non-hazardous chemicals.

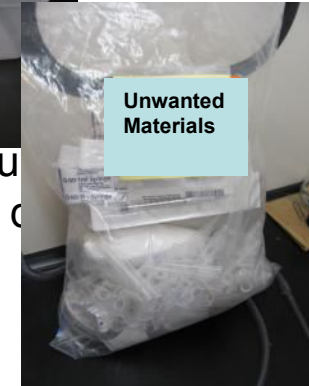
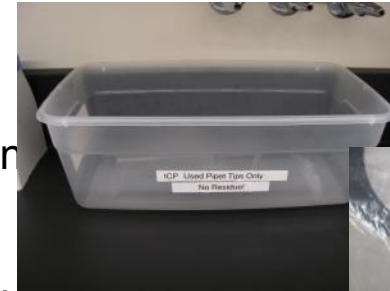


source: www.mysafetysign.com



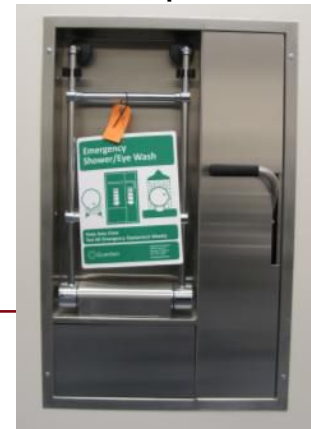
Waste Disposal

- Dispose of used **pipette tips** in the proper labeled container. Do NOT put directly in the trash.
- Gloves, paper towels and other clean-up contaminated with **nanomaterials** should be collected **in a plastic bag INSIDE the fume hood.** Do not dispose in regular trash or expose to lab air.
- Dispose of **broken and cracked glass** ware and disposable glass pipettes in the proper glass container. Glassware should be cleaned by **triple rinsing prior to disposal!** If the glassware contained or was used to handle hazardous materials collect the rinse water and dispose of in the proper unwanted materials waste container, do NOT pour down the sink!



Accidents for chemicals

- **Eye Contact:** Promptly flush eyes with water for a minimum period (15 minutes) and seek medical attention.
- **Ingestion:** Encourage the victim to drink large amounts of water and seek medical attention.
- **Skin Contact:** Promptly flush the affected area with water (15 minutes) and remove any contaminated clothing. Seek medical attention.
- All injuries or illnesses shall be reported to the **Insurance Department (935-5547)** for medical treatment authorization, and **Environmental Health and Safety (362-6816)** for analysis and recommendations for future prevention of the incident. Complete the Report of Injury or Illness form available at the Insurance Department website at <http://www.insurance.wustl.edu> or in the Blue Book.





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Safety for Nanomaterials

Safety Quiz





Nanomaterials in the Lab

- Nanomaterials are of interest not just because they are small, but because some material properties change at the nano scale.
- At the nanoscale some materials show unusually high reactivity, especially for
 - **Fire**
 - **Combustion**
 - **Catalytic reactions**
- Some **low-solubility nanoparticles may be more toxic than the same material in larger particles**, in part because they are small enough to translocate to other organs in the body.
- Specific guidelines are limited, but research suggests that some conventional engineering controls such as **fume hoods are effective at minimizing exposure**.
- According to the National Research Council's *Prudent Practices for Handling Hazardous Chemicals in Laboratories* lab personnel should handle “all new compounds, or those of unknown toxicity, as though they could be acutely toxic in the short run and chronically toxic in the long run.”





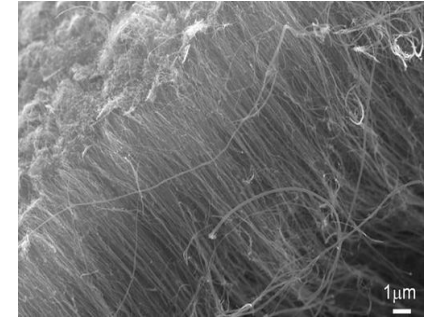
Evaluating Risk

- Before working with a nanomaterial you should understand what risks may be associated with that material.
- Know as much as possible about your material (Chemical composition, Reactivity and toxicity, Size and shape, Solubility, Form/Medium)
 - Materials that are **hazardous or reactive** in bulk form will be hazardous and reactive in nanoparticle form (and likely to a greater extent)
 - Particles in a **loose dry powder** form are a **greater exposure threat** than particles in liquid suspension
- At the very least know which of the following 4 categories your nanoparticle is in:
 - **Fibrous** – **insoluble**, much **larger length than width** (carbon nanotubes)
 - **Toxic** – classified as a **health hazard** in its bulk form
 - **Insoluble** – particles that **do not dissolve** easily in water that are not Fibrous or Toxic
 - **Soluble** – particles that **dissolve in water** and are not Fibrous or Toxic



Evaluating Risk

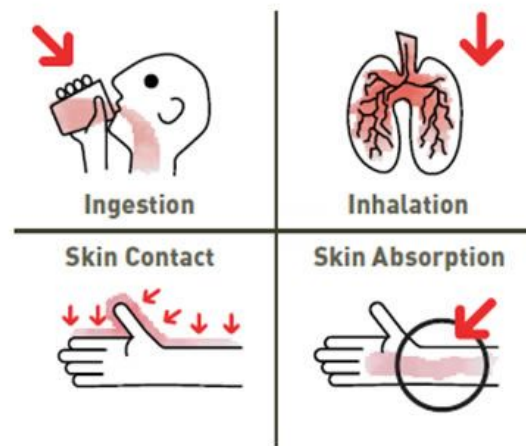
- **Fibrous** particles pose a higher risk than most particles as they do not dissolve in water (or in the body) and their shape makes them prone to puncturing cell walls. **Use extreme caution** when handling and **avoid any exposure to dry powders** of fibrous particles. **Always use a fume hood!**
- **Toxic** particles should be handled with **extreme caution**. The small size of toxic nanoparticles means that they may translocate within the body to organs where their toxic effect may be intensified.
- **Insoluble** particles pose less risk than fibrous or toxic particles, but should be **handled with caution** as they do not dissolve in water and hence may be retained within the body.
- **Soluble** particles pose the least amount of risk, however should still be **handled carefully** until further information about the risks of the particles is known.



www.sciencelearn.org

Evaluating Exposure

- **Exposure** to nanoparticles may occur during **production, cleaning, transfer, and analysis** of the materials.
- The possible exposure routes include inhalation, dermal contact, and ingestion.
 - **Inhalation** is the greatest concern when working with **dry powders**
 - **Dermal contact** is the greatest concern when working with **liquid suspensions**
- **Anyone who visits the lab may be exposed** including research scientists, custodial staff, and visitors therefore those working with the nanoparticles should take precautions to minimize incidental exposure.



<http://www.pan-uk.org/health/routes-of-exposure>



Controlling Exposure

Free Particle State (Dispersible)

- **Loose Dry Nanoparticles**

- Perform work in an enclosure such as a **glove box or fume hood**, if absolutely necessary to perform work outside of an enclosure use local exhaust such as a snorkel hood

- **Particles in Liquid Suspension**

- Performing work in a **fume hood is preferred, local exhaust acceptable**, if quantities are small and engineering controls are not available minimize number of people exposed

Fixed Particle State

- Particles embedded in a larger solid material

- Work may be **performed in open air provided the solid is not being crushed** (particles are not being released from solid)

- Particles fixed to surface of larger solid material

- If particles may be easily scraped or scratched off the surface minimize the number of people exposed or use engineering controls (fume hood)





Lab Hygiene and Practices

- **Minimize areas where nanoparticle contamination may occur**
- Regularly **clean surfaces** where nanoparticles might settle by **WET wiping never use dry wiping or vacuuming** to clean nanoparticles
- **Transport nanoparticles between work areas in tightly sealed containers** preferably also within secondary containment such as a “zip-lock” bag
- **Label containers with contents, possible hazards, and name**
- **Wear nitrile gloves** and routinely inspect for tears or double glove
- Keep contaminated clothing and protective equipment (gloves, lab coats) in the lab



Waste Streams

- **Do not put nanomaterial containing or contaminated waste directly in regular trash**
- **Solid waste should be double bagged** (if the waste was created in a fume hood bag it in the fume hood)
- If the **particles are non-hazardous** (in bulk form) may put **double bagged waste in trash**
- If the **particles are considered hazardous** have **EHS pick up double bagged waste**
- **Do not pour liquid waste containing nanoparticles down the drain** (acceptable only if the particles have been completely dissolved and are not considered hazardous)
- **Store liquid nanoparticle waste that is hazardous or not dissolved in unwanted material waste bottle** and have EHS pick up the waste.





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Please go to <http://www.surveymonkey.com/s/nrfsafety>
and complete the Nano Research Facility and Jens Lab
Lab Safety Training Quiz.

