NRF Clean Room Training

Nano Research Facility:

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A. General Information

1. Basic rules and procedures. The following apply to the NRF cleanroom:

   (a) Training and cleanroom access
       - All users, internal or external, must first complete the annual safety training offered through the EH&S department.
       - All users must complete laboratory specific training prior to gaining access and using the cleanroom.
       - Each user will be provided with an access card for the key card reader at the cleanroom entrance.

   (b) Gowning and personal storage
       - Each user receives a hood, a garment and a pair of cleanroom boots. Dress according to the gowning policy. Do not step close to the cleanroom door with your street shoes.
       - Users choose their own lockers for their cleanroom clothes.

   (c) Cleanroom specific information
       - Any “NEW” chemicals brought into lab, must first be approved by Staff. Confirm there is a MSDS for the chemical(s) you wish to bring in.
       - Do not bring Kleenex, card board, or any particle producing products into cleanroom. If you bring paper into cleanroom, do
not tear it out of a notebook or rip paper; **however, cleanroom paper and notebooks are preferred.**

- All approved items that are brought into the cleanroom must be wiped down to remove dust particles and oil.

### B. Chemical Safety Policies

#### 1. Basic rules and procedures

The following general principles should be used for essentially all laboratory work with chemicals:

(a) **Accidents and Spills**

- If the spill occurs outside of a fume hood (i.e., the chemical and/or fumes are uncontained), all lab personnel must leave the lab immediately.

- Do not attempt to clean up a hazardous 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 the lab manager, Dr. Yujie Xiong at 5-4530.

- 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](http://www.insurance.wustl.edu).

- **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.

(b) **Avoidance of "routine" exposure:** Develop and practice safe habits that avoid unnecessary exposure to chemicals by any route:
- Do not smell or taste chemicals.
- Vent apparatus that may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices.
- Inspect gloves and test glove boxes before use.
- Do not allow toxic substances to be released in cold rooms and warm rooms, since these have contained, recycled atmospheres.

(c) **Choice of chemicals**: Use only those chemicals for which the quality of the available ventilation system is appropriate.

- Know about the chemicals you work with by reading MSDS for detailed information.
- Any chemicals brought into the cleanroom for private group use must be clearly labeled with user name, group (supervisor) name, contact information (email or phone number), chemical name (chemical formula), and the date the chemical was brought in. A MSDS (Material Safety Data Sheet) is to be supplied by the user. The MSDS binder is located on the desk outside the Clean Room. A chemical log book is for entry of any Chemical(s) brought into the Clean Room.
- No open containers of liquids are permitted in the storage cabinets. Containers must be vapor-sealed. Containers covered with foil are unacceptable.
- Refill the solvent squirt bottles when they drop to 25% full. The supply bottles are kept under the hood. **Be sure to check that you are refilling with the correct solvent!** When refilling, avoid touching the squirt bottle draw-tube to any unclean surface.
- Collect all solvent waste into the Halogenated and Non-Halogenated waste containers in the solvent hoods. When full, transfer to the larger waste containers found elsewhere in the lab.
- Acid waste should be collected in a suitable, properly labeled container.
• Clean up any countertop spills immediately
• **Make sure you DO NOT use the solvent hood for acid operations, and vice-versa.** The two types of hoods have separate exhausts, drains, and different materials of construction.

• Dispose sharps (glass slides, silicon wafers, needles, blades, etc.) in proper Sharps containers.

• Chemicals should not be stored on the floor where they could easily be knocked over. If it is necessary to place chemicals on the floor, they must be in a secondary container and separated by hazard class.

• Select chemical carcinogens shall only be used in the designated area. In this laboratory, the designated area is _______________. Only persons with specific training in the handling of chemical carcinogens shall enter the designated area.

(d) **Eating, drinking, smoking, etc:**

• Eating, drinking, smoking, handling contact lenses and applying cosmetics is strictly prohibited in areas where hazardous laboratory chemical or biological materials are used or are intended for use.

• Storage of food and beverage in containers or in areas that are intended for storage of hazardous laboratory materials is prohibited.

(e) **Equipment and glassware:** Handle and store laboratory glassware with care to avoid damage.

• Inspect glassware before each use and do not use damaged glassware.

• Use extra care with Dewar flasks and other evacuated glass apparatus. Shield or wrap them to contain chemicals and fragments should implosion occur.

• Use equipment only for its designated purpose (See Equipment Policies below).
(f) **Exiting:** Remove gloves and wash areas of exposed skin well before exiting the laboratory.

(g) **Horseplay:** Avoid practical jokes or other behavior that might confuse, startle or distract another worker.

(h) **Mouth pipeting:** Do not use mouth for pipeting or starting a siphon.

(i) **Personal apparel:** Confine long hair and loose clothing. See Dress Code.

(j) **Personal housekeeping:** Keep the work area clean and cluttered, with chemicals and equipment properly labeled and stored. Clean up the work area on completion of an operation or at the end of each day.

(k) **Personal protection:** Assure that all persons, including visitors, wear appropriate eye protection where chemicals and biological agents are stored or handled.

- Wear appropriate gloves when the potential for contact with toxic materials exists. Inspect the gloves before each use and replace them periodically or when damaged.

- **Nitrile gloves** (large, medium & small) are available in cleanroom. You may bring your own gloves into cleanroom, but they must be powder free.

- Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls. The Environmental Health and Safety Office will determine if respiratory protection is required.

- Use any other protective and emergency apparel and equipment as appropriate.

- Remove laboratory coats immediately upon significant contamination.

(l) **Planning:** Seek information and advice about hazards before starting an experiment. Plan appropriate protective procedures, and positioning of equipment before beginning any new operation.

(m) **Unattended operations:** Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the
event of failure of a utility service (such as cooling water) to an unattended operation.

(n) Use of fume hood: Use the fume hood for operations that might result in release of toxic chemical vapors or dust.

- As a rule of thumb, use a fume hood or other local ventilation device when working with any appreciably volatile substance with a TLV (Threshold Limit Value) of less than 50 ppm.
- Confirm adequate fume hood performance before use. Keep the fume hood sash closed at all times except when adjustments within the fume hood are being made.
- Keep materials stored in a fume hood to a minimum and do not allow them to block vents or airflow. Hazardous materials should be at least 6 inches behind the sash of the fume hood.
- Leave the fume hood "on" when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off."
- NEVER leave any liquid-filled container in a hood without a label. The label must provide the following information: the container's contents, user name, supervisor name, expected time of disposal, and a phone number where you can be reached if there are questions. Maximum time for unattended chemicals is 12 hours.
- No chemicals, glassware, etc., should be left in fume hoods, or benches.

(o) Vigilance: Be alert to unsafe conditions and see that they are corrected when detected.

(p) Waste disposal: Ensure that the plan for each laboratory operation includes plans and training for waste disposal in accordance with Washington University programs.

- Deposit chemical waste in appropriately labeled (EHS yellow hazardous waste labels) receptacles (fill out and apply label to container when accumulation begins) and follow all other waste disposal procedures of the Laboratory Chemical Hygiene Plan and University Hazardous Waste Disposal Guidelines. The yellow "Hazardous Waste" labels are available from EHS at no
cost, and MUST be on every container of hazardous chemical waste at the time accumulation begins or when an original chemical container is declared unwanted.

- Do not discharge to the sewer 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 the EHS office at (314) 362-6816.

(q) **Working alone**: Avoid working alone in a building. Do not work alone in a laboratory if the procedures being conducted are hazardous.

- **Operation of ALL equipment or doing ANY process off-hours requires a MINIMUM of TWO authorized users (“2 buddies”) in Clean Room at all times.**

C. **RESS CODE**

1. **Basic rules and procedures.**

   (a) Cleanroom users should follow the industry-wide dress code standard for working in and around areas where hazardous materials are used. In general, the user’s clothing should be clean and free of dust and debris. Clothing made of any material that may easily shed fibers inside the clean room should be avoided. This may include clothing made of fur or faux fur or any similar material.

   (b) Acceptable dress for clean room users would include full length shirts and pants and closed toe shoes. Tank tops and halter tops are not allowed. Pants should be full length, running from the waist to the ankle. Shorts, skirts and Capri pants are not allowed. In the summer months, hospital type scrubs may be worn over shorts.

   (c) Shoes must be clean and dry and free of dust and dirt before entering the cleanroom. Users must wear closed toe shoes that fully cover the toes, heels, and top of the foot. Sandals, shoes with high heels and shoes with deep cleats that could trap dirt are not appropriate for cleanroom use.

   (k) Safety glasses that meet the ANSI Z87.1 – 1989 standard should be worn at all times. Safety glasses however, should not be used as
an alternative to a full face-shield which should be worn when working with chemicals.

- Safety goggles are required at all times while in the cleanroom, even if you have regular prescription glasses.

(l) Contact lenses are allowed in the cleanroom.

D. HYDROFLUORIC ACID USE

1. Basic rules and procedures:

(a) **Hydrofluoric Acid (HF)** – Hydrofluoric acid presents a significant hazard. This acid is widely used in the NRF in both its pure and diluted form. It is also an active component of Buffered Oxide Etch (BOE) and is used for etching silicon dioxide or for stripping the native oxide growth prior to subsequent processing steps. HF is dangerous because a person may not notice an HF “burn” initially. The acid will eat away at the flesh until it reaches the bone, causing extreme pain.

(b) Because HF etches glass, it must not be kept in a glass bottle or used in glass beakers or disposed of in a glass hazardous waste container. Instead, plastic lab ware should be used. **HF must only be used in the chemical fume hood specific for acids. It must not be removed in a beaker from the hood!**

(c) Regardless of the concentration of HF, it may NOT be disposed of down the drain! Collect waste HF in a clearly labeled, appropriate container with a screw cap. Glass and metal are unsuitable containers. Do not mix different kinds of acids together.

(d) **HF can only be used in the HF (& BOE) designated area ACID USE area.**

(e) HF & BOE etch glass (SiO₂), and should only be kept in Nalgene containers.

(f) Neoprene gloves are available to protect skin from HF acid. Double glove when handling HF (Nitrile gloves first then Neoprene on outside).

(g) Always use FULL FACE SHIELD, ACID APRON, and double glove when using HF.
(h) If you are exposed to H F, useCalc ium gluconate as an antidote. This is kept in the cabinet.

(i) User should seek m edical atten tion imm ediately and notify NRF staff upon ANY exposure to HF. Follow the proper notification steps indicated in Section B above.

E. CHEMICALS PROVIDED TO CLEANROOM USERS

1. Basic rules and procedures:

   (a) Solvents:
       • Acetone
       • Isopropyl Alcohol (IPA)

   (b) Acids:
       • Hydrogen Peroxide (H₂O₂)
       • Hydrochloric Acid (HCl)
       • Hydrofluoric Acid (HF)
       • Nitric Acid (HNO₃)
       • Sulfuric Acid (H₂SO₄)
       • Buffered Oxide Etch (BOE)

   (c) Photoresists:
       • AZ 5214
       • SU8 2010
       • SU8 2050

   (d) Developers:
       • AZ 327 MIF
       • SU8 Developer

F. ACKNOWLEDGEMENT

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For presentations and posters, just listing the Nano Research Facility (NRF) is necessary. However, if the NNIN and NSF can be included without causing space issues, that would be preferred.

If you wish to use a NRF logo on your presentation or poster, please email us at NRF-NNIN@wustl.edu. Simply state what the logo will be used on and how it will be used.

G. EQUIPMENT POLICIES

1. Basic guideline:

   (a) The equipment in the NRF facilities is under the responsibility of the staff members. These staff members are responsible for the maintenance, training, and process development. Each tool has a training document or instructions for its use. Users should make sure that they are thoroughly trained on equipment before they operate it. Staff members are available for training sessions on equipment via an online training request form.

   (b) 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 staff.

H. SIGNS & LABELS

1. Basic guideline:

   (a) On the Danforth Campus, near each telephone shall be posted the emergency telephone number for University Police--935-5555.

   (b) On the Danforth Campus, waste chemical containers shall be labeled using the yellow Hazardous Waste label available at no cost from EHS.
(c) Chemicals that are mixed as reagents for later experiments shall be labeled with the chemical name, concentration, hazard warning and target organ information.

(d) Laboratories using hazardous chemicals shall have a sign at the entrance designating the area "Authorized Personnel Only" and "Chemical Hazard."

(e) The original manufacturers label shall be retained without alteration or mutilation on the container or replaced with an appropriate label if the contents are changed.

(f) Good laboratory practice includes dating all chemical containers on arrival and/or upon opening.


I. USER AGREEMENT

I have read the basic operation policies for use of the NRF. I agree on the items and conditions described in these policies.

Name: _____________________________
Student/Employee ID #: _______________________
Instrument: ___________________________
Organization/PI: ___________________________
Contact/Phone: ___________________________
Signature: ___________________________
Date: ___________________________

Approved by: ___________________________
Date: ___________________________