

## 1. Purpose and Scope

- 1.1. This document describes the policies that users must comply with when using chemicals at the Nanofab.

## 2. Definitions

- 2.1. Nanofab: The University of Houston Nanofabrication Facility.
- 2.2. Staff: Nanofab staff members.
- 2.3. User: A person who uses the Nanofab.
- 2.4. Chemical User: A user who is working with chemicals in the Nanofab
- 2.5. Chemical:
- 2.5.1. For the purpose of this document a chemical is defined by the following:
- 2.5.1.1. It is a pure chemical or a mixture of chemicals in any state (liquid, gas or solid.)
- 2.5.1.2. It includes both reagent grade chemicals of the type found in a chemistry laboratory and proprietary mixtures such as cleansers, developers, etchants, etc.
- 2.5.1.3. It includes all chemicals regardless of how hazardous or non-hazardous the chemical is.
- 2.5.2. For the purpose of this document the following are not considered chemicals:
- 2.5.2.1. Ambient air
- 2.5.2.2. Materials such as metal, plastic, rubber, etc. when used as a construction material or when in the form of a non-hazardous commercial product (e.g. tape, pens, paper, etc.) and when not used as a reagent in a chemical process.
- 2.6. Chemical Process: Any activity involving the use of chemicals
- 2.7. PPE: Personal protective equipment (e.g. gloves, goggles, safety glasses, etc.)

2.8. PI: Primary Investigator, usually the professor responsible for paying user fees.

### 3. Policies

#### 3.1. General Chemical Policies

- 3.1.1. The use of chemicals at the Nanofab is a privilege. All facility users are automatically granted this privilege but it can be revoked.
- 3.1.2. The staff's role is to provide oversight and to insure compliance; all other aspects of chemical use are the responsibility of the chemical user.
- 3.1.3. In addition to following the specific policies written in this document, the chemical user's responsibility extend to maintaining a 'zero adverse impact' to the Nanofab throughout the total life cycle of the chemical (*i.e.* intake, storage, use, cleanup, waste storage, waste disposal, removal, etc.).
- 3.1.4. Failure of the Nanofab to provide some item (*e.g.* glassware, absorbent, neutralizer, solvent, label, marker, ... etc.) is not a valid excuse for failure of a user to comply with the policies in this document. It is the chemical users responsibility to insure that all necessary items are available and to provide them if they are not.

#### 3.2. Communication

- 3.2.1. Chemical users have a responsibility to communicate relevant information about their chemicals and their chemical process to other users and staff. This responsibility includes communicating information about both real hazards and perceived hazards.

Examples:

- 3.2.1.1. A beaker full of nitric acid would be a real hazard and should be labeled if left unattended for any length of time.
- 3.2.1.2. A beaker full of water would be a perceived hazard because nobody other than the person who filled it with water knows what's inside. The beaker of water would need to be labeled if left unattended. (Note: The Nanofab has the deadly chemical HF on site; because it cannot be easily distinguished

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from water unlabeled beakers of water have to be treated very carefully and disposed of as unknown chemical waste which can be very expensive to the University.)

- 3.2.2. The responsibility to communicate is not limited to labeling but in most cases labeling will be the primary means of communicating information about chemicals. Labels need to be legible and if the label could be exposed to a solvent that could remove the ink it must be protected by a transparent cover sticker.

### 3.3. Intake/Outtake Procedures

- 3.3.1. Chemical users are responsible for reporting any chemicals that they bring into the facility to the staff and for providing a MSDS if the staff does not already have one for that chemical. Chemical users are also responsible for reporting when they use up or remove a chemical.
- 3.3.2. The requirement of section 3.3.1 will normally be fulfilled by entering the information into the Nanofab Inventory database. However, if the database is not working or otherwise unavailable the chemical user is still responsible for reporting the information to the staff and should do so via email
- 3.3.3. The chemical user is responsible for transporting chemicals to and from the Nanofab in a safe and appropriate manner (*e.g.* using a secondary container if required.) The chemical user is also required to clean up any mess that might be generated in the process (*e.g.* some chemicals are packed in vermiculite, a light weight dirt-like substance used as an absorbent in case of a spill, which can get all over the place when the chemical is unpacked; the user would need to clean this up – ask staff for advice.)

### 3.4. Appropriate Chemical Storage Location

- 3.4.1. Chemicals must be stored in an appropriate location in accordance to the hazards that the chemical presents.
- 3.4.2. It is the chemical user's responsibility to make sure chemicals are stored in the appropriate location. Staff will provide advice if requested.
- 3.4.3. If staff finds chemicals stored in inappropriate locations they may:
- 3.4.3.1. Relocate the chemical
  - 3.4.3.2. Dispose of the chemical

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3.4.3.3. Contact the owner and instruct him or her to relocate the chemical

### 3.5. Long Term Storage and Removal

- 3.5.1. Long term storage of chemicals is allowed but permanent storage is not.
- 3.5.2. Chemical users need to affix an official Nanofab removal date label to their chemical. Once this date has passed ownership of the chemical transfers to the Nanofab and the staff will decide if the chemical should be disposed of or made available for all users. The removal date can be extended by affixing a new label prior to the date listed on the old label. (It is not necessary to remove the old label; the official removal date will be the one that is farthest in the future.)
- 3.5.3. Affixing the removal date label is the responsibility of the chemical user, even if this means triggering a cleanroom access fee. The staff will not affix the label.
- 3.5.4. UHV Sputtering Targets are an exception to this rule, they will be kept by the staff until the user or PI requests the target be returned.
- 3.5.5. Items kept inside a user or group storage bin do not need a removal date label, however, chemicals need to be stored in appropriate locations and the user storage bin would not normally qualify as an 'appropriate location' except in the case of non-liquid samples.

### 3.6. Chemical Waste

- 3.6.1. The chemical user is responsible for all waste generated from his or her chemicals and chemical processes.
- 3.6.2. The chemical user is responsible for providing a suitable waste container. It must be made out of a material that is chemically compatible with the waste and if there is the possibility of pressure build up inside the container it must be designed to handle it safely.
- 3.6.3. The chemical user must make sure the waste container is labeled legibly and appropriately. If there is the possibility of a solvent removing the ink on the label the label must be protected by a transparent cover sticker.

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- 3.6.4. The chemical user is responsible for storing the waste container in an appropriate location.
- 3.6.5. Sharing waste containers between chemical users is encouraged; this allows us to save space by not having too many waste containers around. However, chemical users should only put waste in containers if they know that the waste is compatible with the container and the existing waste already inside. Waste containers need to be labeled with all chemical contents so if a new chemical is added the old label must be updated or an additional label should be affixed.
- 3.6.6. When the waste is ready to be removed it is the chemical user's responsibility to transport the waste to the airlock at the back of the third bay in the cleanroom. Staff should then be notified via email message which includes an affirmation that the waste is appropriately labeled, a description of the type of waste, the waste container and the volume of waste. (*e.g* "I placed two bottles of appropriately labeled acetone waste, each containing approximately 2 liters of waste.")
- 3.6.7. If waste is generated outside the cleanroom or if for some reason it is inappropriate to transport or store the waste in the airlock it is the chemical user's responsibility to make sure that the waste is disposed of properly. Staff should be informed via email.

**3.7. Chemical Handling**

- 3.7.1. Chemical users must wear appropriate PPE and must use appropriate equipment when handling chemicals. It is the chemical user's responsibility to provide the PPE and equipment if it is not provided by the Nanofab.

**3.8. Spills and Emergencies**

- 3.8.1. Chemical users must be familiar with the hazards associated with their chemicals and be prepared to respond in case of a spill or other emergency.
- 3.8.2. For minor spills that do not present a safety hazard it is the chemical user's responsibility to clean up the spill. If there is solid waste contaminated with liquid chemicals it is the chemical user's responsibility to figure out how to dispose of it safely and to communicate the disposal technique to other users, staff and/or building janitors if any of them could be at risk.
- 3.8.3. For larger spills or for any chemical emergency the chemical user is responsible for assisting the Nanofab staff in responding to the situation. In the event that no staff member is available, the chemical user is responsible for evacuating everyone from the

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area, getting assistance from campus police (713-743-3333) and making sure people stay clear of the area until help arrives.

### 3.9. Protocols

- 3.9.1. Chemical users are required to have a written and signed protocol for any chemical process they perform at the Nanofab.
- 3.9.2. Protocols must be signed by the chemical user. This signature indicates that the user has addressed every step of the chemical process and has specified appropriate equipment, PPE, and procedures to carry out the chemical process safely and without leaving a mess or causing damage to the Nanofab.
- 3.9.3. If a chemical process is hazardous, the user must get a second signature from someone knowledgeable who agrees to review the protocol. Nanofab staff will not provide this signature.
- 3.9.4. If a chemical process is extremely hazardous the user must get the signature of his or her PI and must provide a copy of the protocol directly into the hands of a staff member and must explain the hazards to the staff member at that time.
- 3.9.5. Protocols are automatically approved as soon as they are submitted; users do not need to wait for staff to review the protocol. Staff will review the protocol periodically and may reject a protocol if it is deemed incomplete or unsafe; if this occurs the user(s) will need to submit a new protocol that addresses the staff's concerns.
- 3.9.6. It is OK for a chemical user to submit a protocol that someone else wrote as long as it fully addresses the user's own chemical process.
- 3.9.7. Protocols are treated as shared information and staff may post parts of protocols or even complete protocols for others to see and use. If staff requests an electronic version of a protocol it must be provided. If a user wishes for a protocol to be kept private the protocol should be delivered to a staff member in his or her office and the protocol should clearly indicate that the information is private and should not be shared with other. All protocols, regardless of privacy concerns, will be made available to staff as well as safety and emergency service personal if required for safety purposes.
- 3.9.8. If requested, staff will provide their best advice with respect to chemical processes, safety and writing protocols. The chemical user is ultimately responsible for the

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protocol; bad advice from staff will not be considered an excuse because it is the user's responsibility to verify and confirm all information before signing the protocol.

3.9.9. Protocols must include the following items:

3.9.9.1. At the top of each page these three items should be clearly visible, they will uniquely identify the protocol:

3.9.9.1.1. Title

3.9.9.1.2. User Name

3.9.9.1.3. Version Number

3.9.9.2. If the protocol is to be private this should be indicated in large letters near the top of each page in the protocol

3.9.9.3. Each page should have a page number

3.9.9.4. There should be a signature block at the end of the protocol with each person's name and role spelled out clearly and a space for each person to sign and a space for each person to date the document. Each person must sign and date the protocol before it can be submitted

3.9.9.5. List of chemicals

3.9.9.6. List of supplies/equipment

3.9.9.7. List of PPE

3.9.9.8. List of special hazards and any special procedures for responding to spills or emergencies.

3.9.9.9. Procedures for carrying out the chemical process

3.9.9.10. Procedures for waste disposal

3.9.9.11. Procedures for cleaning

3.9.10. A protocol template is available as an attachment to this document, you may use this template but you are not required to do so.

3.9.11. If multiple versions of the same protocol are submitted by a user, the one with the highest version number is the only one that may be used. If the user wants to use an older version as well, a separate protocol with a new title should be submitted.

3.9.12. Protocols are not meant to be busy work or to be over burdensome. Time spent on the protocol should be time spent thinking about how you will perform the chemical process not time spent thinking how to write the protocol perfectly. As long as you fully understand what you are doing, how to do it safely and how to clean up, then don't waste too much time writing the protocol, just make sure you cover the requirements from section 3.9.9 and that's it. The staff may reject your protocol, don't take it

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personally, just spend more time writing in the sections the staff took issue with and resubmit it.

3.9.13. Protocols should be as general as possible. For example, you do not need one protocol for making 100mL of solution and another for making 200mL, the same protocol can serve for both.

3.9.14. The location for submitting protocols will be clearly indicated, asks a staff member if you need help finding it.

3.9.15. The following do not require a protocol:

3.9.15.1. Chemical process integrated with a tool (e.g. gas lines attached to the reactive ion etchers.) (Note that photoresists and developers are not considered integrated to any of the lithography tools, they require protocols.)

3.9.15.2. Using solvent squeeze bottles for cleaning purposes

3.9.15.3. Using nitrogen gas gun for cleaning purposes.

3.9.15.4. Using water for cleaning purposes.

### 3.10. Afterhours

3.10.1. Use of chemicals is prohibited afterhours. This is a universal policy that applies to all users no matter the reason for their presence afterhours. (Note: Afterhours access is granted to a few users under certain circumstances but it is the intention of the Nanofab that the number of people with afterhours access be kept small.)

The following are exceptions to the prohibition on afterhours chemical use:

3.10.1.1. Solvent squirt bottles when used for purposes of cleaning.

3.10.1.2. Nitrogen gas spray guns when used for purposes of cleaning

3.10.1.3. Water

3.10.1.4. Chemicals integrated into a tool (e.g. house compressed air, house nitrogen, gallium source on the FIB, RIE gasses, sputtering targets, etc.). Chemicals used in association with the spin coater are not considered 'integrated' and are not allowed.

3.10.1.5. Samples are considered chemicals for the purpose of this document but they may be used afterhours as long as they are not hazardous and as long

as they are solid (not liquid or gas). Premade samples with photoresist may be used but they may not be developed afterhours.

### **3.11. Remediation**

3.11.1. Users who do not abide by the policies described in this document may be subject to one or more of the following actions at the discretion of the Nanofab Manger and with approval of the Nanofab Director.

3.11.1.1. Warnings

3.11.1.2. Temporary suspension of access to the Nanofab

3.11.1.3. Revocation of chemical use privileges

3.11.1.4. Permanent banishment from the Nanofab

3.11.1.5. Noncompliance fees (Note that when there is a threat to health and safety, noncompliance fees can be applied on the first incident, without prior warning to the user's PI.)

## **4. References**

4.1. None

## **5. Revisions**

5.1. Version 01

5.1.1. No revisions.

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## 6. Signature Block

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Name: Jing Guo

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Date: \_\_\_\_\_

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## 7. Attachments

7.1. Protocol Template

**UH Nanofabrication Facility – Protocol**

**Title:** Title of Protocol  
**Name:** Your Name  
**Version:** Version Number

**Purpose**

**Chemicals**

**Supplies/Equipment**

**PPE**

**Special Hazards and Related Procedures**

**Procedure**

**Waste Disposal**

**Cleaning**

**Signatures**

	Signature	Date
Name: Your Name Role: User		
Name: Reviewer or PI's Name Role: Reviewer or PI		