# TABLE OF CONTENTS

- **MIRC Equipment Training** ................................................................. 5
- **MIRC Cleanroom Website** ................................................................. 7

**Policies and Procedures Highlights** .................................................. 8

**Policies and Procedures** ................................................................ 9
  - I. Introduction .................................................................................. 9
  - II. Enforcement ................................................................................ 10
  - III. Equipment Schedule Rules ....................................................... 10
  - IV. Access to the Cleanroom ............................................................ 10
    - A. Bringing items into the Cleanroom ........................................... 11
  - V. Buddy System ............................................................................. 11
  - VI. Visitors .................................................................................... 11
  - VII. Procedures and Courtesies ....................................................... 11
  - VIII. Wafer Handling ..................................................................... 11
  - IX. Tools and Repairs ..................................................................... 11
  - X. Good Manners and Good Sense ................................................. 11
  - XI. Habits ........................................................................................ 11
  - XII. General ................................................................................... 11
  - XIII. Personal Hygiene ................................................................. 11

**Spill Response Procedures** ............................................................... 11
  - I. Introduction ................................................................................ 11
  - II. Spill Response Cart Items ............................................................ 11
  - III. “I’ve Spilled a Bottle of ----” ..................................................... 11
  - IV. “I’ve Found a Chemical Spill” .................................................... 11
  - V. First Aid ..................................................................................... 11

**Cleanroom Gowning Procedure** ...................................................... 11
  - I. Introduction ................................................................................ 11
    - A. Clean Shoes with Shoe Scrubber ............................................. 11
    - B. Put on Shoe Covers Located Inside at the Entrance of the Gowning Room ......................................................... 11
    - C. Place Hat, Coat and Any Other Street Garments in Lockers ..... 11
D. Carefully Put on a Hood or Cap

E. Remove your Cleanroom Garment from Storage Cabinet

F. Put on Jumpsuit (Gown)

G. Put on Booties

H. Put on Cleanroom Gloves

I. While in the Cleanroom

II. Notes

Cleanroom Etiquette 1001

I. Disposal of Damaged or Non-Functional Equipment

II. Broken & Uncleanable Glassware/Wafers/Other Sharp Objects

III. How to Make the Laundry Guy Really, Really Happy

IV. Labeling Things When You Can’t Stick Around to Watch Them

V. Disposal of Solvent & Photoresist-Soaked Materials

VI. What if I Don’t Know How to Use Something, or if it Malfunctions While I’m Using it

VII. What are the Procedures for Cleaning Up

VIII. How Do I Store Things

IX. What if I See Someone Else Doing Something Wrong

Cleanroom Rules

1. Authorized User for the Equipment

2. Granting Access

3. Someone Else’s Buzz Card

4. Without Supervision

5. Equipment Reserved

6. Undergoing Maintenance

7. Scheduler

8. Equipment Time Limit

9. Log-In

10. Log-Out

11. Re-labeling Properly

12. Chemical Safety Warning Sheets

13. Safety Equipment

14. Clean-Up
15. Unauthorized Entry

16. Allowing a User to Enter the Cleanroom

17. Tote-Boxes Unattended

18. Damage to

19. Proper Gowning and Degowning Procedures

20. Removing Supplies and/or Equipment

21. Equipment Settings

22. Improper Usage of Safety Apparel

23. Failure to Leave Cleanroom in Emergency

Pettit Building Cleanroom Facilities & Emergency Exits

Final Note
WARNING!!! DO NOT ENTER THE CLEANROOM OR USE ANY EQUIPMENT UNTIL YOU HAVE FOLLOWED THE PROCEDURES OUTLINED BELOW. IF YOU NEED HELP IN UNDERSTANDING THESE INSTRUCTIONS, PLEASE ASK A CLEANROOM STAFF MEMBER. THE PENALTY FOR NON-COMPLIANCE IS SUSPENSION OF CLEANROOM PRIVILEGES.

A user must be trained before he/she is allowed to operate any equipment in the MiRC cleanroom. The following is the basic procedure for a newcomer to be eligible for equipment operation.

1. Participate in a cleanroom orientation. You may apply to become a cleanroom user after this mandatory prerequisite. Contact the administrative staff at admi@grover.mirc.gatech.edu for the information on the orientation schedule and how to become a cleanroom user. After you become a cleanroom user, you will be granted cleanroom access and added to the Cleanroom user mailing list. All cleanroom-related information is circulated through this mailing list.

2. Consult with your advisor and get his/her approval on the equipment for which you should be trained. Plan one month ahead on what equipment you are going to use since the training class is offered once a month. Do not sign up for the class if you are not going to use that equipment in the near future.

3. Go to the web page http://grover.mirc.gatech.edu/training/view.php to sign up for a class. The sign up is on a first-come first-serve basis. If you are unable to sign up for a class due to its limited size or no class is offered on the equipment you need, please follow the instruction to request a new class.
4. After you sign up for class, read the equipment instructions from the web page http://grover.mirc.gatech.edu/equipment.

5. Arrive at the training site (equipment site) on time. Please bring a set of printed instructions and your cleanroom notebook with you and try to get hands on experience during the training.

6. You may ask anybody in your group who has been checked off to go over the equipment after your training session. Make sure to practice on the tool before your check off.

7. Make an appointment with your instructor for your check off. The instructor will determine whether you are qualified to operate that particular equipment and whether you are eligible to be checked off.

**Remember:** You are allowed to operate the equipment only after your instructor qualifies you. Unauthorized operation may cause equipment down and delay many research projects. If you have any equipment training-related questions, please contact the cleanroom staff.
MiRC Cleanroom Website
POLICIES AND PROCEDURES HIGHLIGHTS

REQUIRED ATTIRE: Hood, gown, booties w/shoe covers, masks, gloves, and safety eyewear. Bouffant caps are required for long hair.

Keep all hair and ears covered with hood or cap.

Never open your gown in the cleanroom.

Never touch your skin with your gloves. If you do, put on clean gloves immediately.

Only authorized users may enter the cleanroom unescorted.

The buddy system must ALWAYS be used in the cleanroom.

Visitors must be escorted by a cleanroom qualified faculty/staff member.

Visitors must sign in/out in the visitor log.

No food or drink is permitted in the cleanroom.

No corrugated cardboard, styrofoam, foam rubber or non-cleanroom paper is permitted in the cleanroom.

No pencil, erasers or retractable pens are permitted in the cleanroom.

Be considerate by cleaning up your own mess, not messing up someone else's work, letting the staff know when new supplies are needed, etc.

Ask for permission before bringing anything in or taking anything out of the cleanroom.

DO NOT modify equipment without the approval of the MiRC Staff.

IF YOU AREN'T SURE HOW IT WORKS, ASK BEFORE YOU USE IT!

Follow the MiRC and Georgia Tech Safety Guidelines.

MiRC staff contact information: http://grover.mirc.gatech.edu/showStaffContact.php
POLICIES AND PROCEDURES

I. Introduction

A Class 10 cleanroom is defined as having less than 10 particles of more than 0.5 micron in size within a cubic foot of air. Similarly, a Class 1000 cleanroom has less than 1000 particles of more than 0.5 micron in size within a cubic foot of air. This level of cleanliness is necessary to maintain the reproducibility of newly developed state-of-the-art electronic device processes. To reach and maintain this level of cleanliness, the transfer of particle and chemical contaminations must be eliminated wherever they are found.

Your attitude towards cleanliness will ultimately determine the success or failure of any cleanroom policy. All the elaborate equipment installed to provide a microscopically clean or controlled atmosphere would be to no avail if our users do not believe in and help enforce these policies. It is also recognized that technology is continually changing and that cleanroom users are a tremendous resource for new ideas. With this in mind, you are strongly encouraged to recommend changes that may make the facility safer, cleaner, easier to use, or less expensive to maintain.

When in the cleanroom, be aware of your knowledge limitations. It is extremely important that you ask someone for help if you are unsure about the operation of these facilities.
II. Enforcement [http://grover.mirc.gatech.edu/data/cleanroomPolicy.php](http://grover.mirc.gatech.edu/data/cleanroomPolicy.php)

The policies and procedures described here are intended to ensure the safety of our users, protect the equipment in the cleanroom and to create an environment in which many different research groups can co-exist peacefully. It is expected that the cleanroom users will police themselves by encouraging and assisting one another in adhering to these policies. Flagrant or repeat offenders will be penalized, typically through suspension or expulsion from the cleanroom. The penalties are defined on the website address above and in the Cleanroom Rules section of the manual, starting on page 32.

III. Equipment Schedule Rules

1. Please schedule your runs in advance when possible. Do not sign up for more time than you think you may need.
2. Comply with your schedule. If you do not log into the equipment within 15 minutes after your time beings, you will lose your time and other users may use the equipment.
3. Remove tooling (boats, sample holders, etc.) from systems and clean-up particles from process chamber. Note any anomalies to the staff and next user.

IV. Access to the Cleanroom

The cleanroom is equipped with a card system, which limits access to authorized users. Users must have a card in order to enter the cleanroom level from the elevator or stairs between 5pm and 8am as well as to enter the cleanroom at all times. Except in the case of emergency evacuations, users are required to use their cards in order to exit the cleanroom. The card system will record the times of entry and exit for each user. This data is used for MiRC accounting purposes. Prior to being given access to the cleanroom, applicants must attend an orientation session on cleanroom safety and procedures. Handouts will be provided at this session including the Georgia Tech General Laboratory
Safety Manual and various policy and procedure handouts. Applicants must sign a form acknowledging that they have read and understood the contents of the handouts. Applicants are also required to take the Cleanroom Entrance Exam after attending the orientation session. The cleanroom is open 24/7 except during Thanksgiving and Christmas holidays. Authorized users are able to come in at any time when open. However, you should always follow the Buddy System as described in section V.

**IV.A Bringing Items Into the Cleanroom**

Many users need to bring items in and out of the cleanroom such as wafers, notebooks, etc., but due to the nature of the cleanroom, you need to be very careful of what you bring in and how clean it is. Certain items are not allowed into the cleanroom: non-cleanroom paper, cardboard, wood, etc. If you are not sure whether an item is allowed inside, please ask a staff member first. Remember, it is better to be safe than sorry. After you know you can bring an item into the cleanroom, you must make sure it is clean. Bring the item into the gowning room then gown up. When you are gowned up and gloved, take a tex wipe, wet it with IPA, and wipe down your item thoroughly. Make sure to get all the nooks and crannies where dust and dirt may hide. Only after the item has been wiped down may it be brought into the cleanroom.

**V. Buddy System**

The buddy system must always be used in the cleanroom. As implemented here, the buddy system requires that a minimum of two people be inside the cleanroom at all times, both of whom should be authorized users. This is to ensure the safety of the users. A list of emergency phone numbers is located in the hallway of the cleanroom and in the corridor outside the cleanroom.
VI. Visitors

PERMISSION IS NECESSARY. Whenever possible, visitors should remain outside the cleanroom where they may view the entire facility through the windows in the corridor. If a visitor must enter the cleanroom he/she must first submit a request online. Once permission is given, they must follow the same policies and procedures as authorized users. They must always be escorted by an authorized user while inside the cleanroom. The escort will be responsible for ensuring that the visitor follows the facility policies and procedures.

VII. Procedures and Courtesies

A. Use special care to keep fume-hoods in ultra-clean conditions.

B. Emergency exit doors are **ONLY** for **EMERGENCIES**, such as fire or explosion in the lab, or for the movement of very large pieces of equipment in and out of the cleanroom. In case of an alarm, exit immediately, **DO NOT** take time to remove your gown until you are clear of the building.

C. **IMPORTANT** – Hot plates (one of the main causes of cleanroom fires):
   1. Never leave on when unattended
   2. Make sure that the temperature is: 20°C below the flash point of its contents and 20°C below the melting point of beaker materials.
   3. Ask for help if you are unsure of any part of the process.

D. Do not walk around unnecessarily and be cautious when approaching another work area. Personnel movement is to be restricted to minimize the stirring up of settled particulate matter.

E. Excess storage in the cleanroom is not permitted.

F. If you turn it ON, remember to turn it OFF.
Examples:
Vacuum Chucks, DI Rinse Tanks, Nitrogen Gas, Hot Plates, etc.

Exceptions:
Pieces of equipment that must be left on all day for practical reasons.

G. If you make a mess, clean it up. Return everything to its original condition, or leave conditions better than you found them. This includes your entire set-up for experiments or projects.

H. Only cleanroom paper or plastic-laminated paper will be allowed in the cleanroom. Cleanroom paper taken out of the cleanroom may be brought back into the cleanroom.

I. At no time will paper in any form be torn or mutilated within the cleanroom. Corrugated cardboard, styrofoam, or foam rubber of any type will not be allowed in the cleanroom without plastic containment and prior approval.

J. Remove cartons and packaging material before taking materials into the cleanroom area.

K. Pencils, erasers, and retractable pens shall not be used within environmentally controlled areas. Non-retractable ballpoint pens are approved for writing purposes.

L. Users will make proper entry each time a piece of equipment is used that has a logbook.

M. Be aware of supplies. If quantities of stock appear to be low, report it to the MiRC staff.

N. Do not remove dedicated items from the cleanroom without the MiRC Staff’s permission.

O. If you require a special equipment set-up, consult the MiRC Staff.
P. If you think you may have accidentally messed up someone's work or equipment, please try to find whose it is and what to do about it.

Q. Do not contaminate the Nitrogen blow off guns.

R. When spinning photo resist, do not allow photo resist to bypass the wafer chuck. The resist will clog the vacuum port in the spindle, potentially causing your sample to fly off of the chuck.

**VIII. Wafer Handling**

A. NEVER sneeze, cough, or spit toward your wafers even with a mask. Resulting spots are non-removable.

B. Never speak towards your wafer.

C. Avoid passing anything over your wafer which may release particles (i.e., don't look down on your wafer, don't cover the wafer with your hand).

D. Whenever possible, store wafers in *covered* containers.

**IX. Tools and Repairs**

A. Vacuum or blow clean all equipment followed by an Isopropyl alcohol wipe before taking it into the cleanroom. No equipment will be modified without prior approval of the MiRC Staff. No new equipment will be moved into the cleanroom without prior approval of the cleanroom manager.

B. Keep parts and tools at the workstation as clean and orderly as possible. Use toolboxes where possible.

C. Any work or tools dropped on the floor shall be considered contaminated, and must be cleaned.

D. Never leave exposed critical parts on the workbench.

E. Work on a clean surface.
F. Operations such as lapping, filing, deburring, and heavy soldering are prohibited in the cleanroom, except where contamination is isolated and exhausted from the clean areas.

X. **Good Manners and Good Sense**

A. Obey signs on equipment or in specific areas.

B. Refill squirt bottles that you find empty.

C. Let empty solvent jugs evaporate dry. Rinse acid and solvent jugs three times with tap water before placing in cart next to cleanroom office.

D. When working with acids or solvents, wear chemical resistant nitrilite/neoprene gloves available in the storage room. Before using the gloves, be sure they are in good shape. Replace them if they are not.

E. Do not dump solvents down the drains. Use the solvent waste bins located at the fume-hoods.

F. When disposing of acid mixtures, dilute with lots of tap water.

G. Label all mixtures with Chemical Safety Warning Sheets available in a bucket in the hallway.

XI. **Habits**

A. If your glove touches bare skin, (i.e., your forehead) replace your gloves immediately.

B. Avoid scratching or rubbing your head or exposed skin areas.

C. Never comb or brush hair within the cleanroom or gowning area.

D. Limit the use of cosmetics, colognes, and perfumes in the cleanroom and gowning areas as much as possible.
E. No eating, chewing, or smoking shall be allowed in any environmentally controlled areas.

**XII. General**

A. Personal items such as combs, cigarettes, matches, tissues, and similar particle-shedding products shall not be carried into the cleanroom. Such items may be carried into controlled areas in street clothes pockets, provided they are not removed from the pockets within the clean area.

B. Do not wear jewelry, except plain wedding bands, watches, and pierced ear studs.

C. Report adverse changes in environmental conditions (particle generation or accumulation, marked changes in humidity or temperature) and/or changes in your physical condition (profuse a nasal discharge, skin conditions, etc.) to the MiRC Staff.

**XIII. Personal Hygiene**

Personnel with colds, temporary sneezing and coughing, and severe sunburns should not enter the cleanroom until they have recovered. The high degree of cleanliness required necessitates the development of the following habits:

A. Bathe frequently

B. Shampoo regularly and take action to control dandruff.

C. Wear clean under and outer garments.

D. Do not wear open-toed shoes, sandals or worn out shoes.
SPILL RESPONSE PROCEDURES

I. Introduction

We use many potentially dangerous chemicals in the cleanroom and the possibility of a major spill always exists. It is necessary to know how to react quickly and properly to any chemical spill to avoid injury, death or major equipment damage. A large acid spill, HF for instance, might cause serious injury or even death if handled improperly. These procedures are intended only to provide guidelines. Common sense should always be used when dealing with any chemical spill. Safe practices should be foremost on your mind whenever you are in the cleanroom.

Be advised: you should never work alone in the cleanroom. MiRC policy dictates that you must have at least one other person in the cleanroom with you at all times.
II. Spill Response Cart Items

The cleanroom spill response cart is located in the cleanroom entrance hall immediately beyond the entrance doors. It is plainly marked as a spill response cart and contains the items you will need to combat a spill.

These items are included in the MiRC cleanroom spill response kit available in the chase between Class 10 & Class 1000 Bays.

- absorbent spill dam
- absorbent pillows
- acid neutralizer
- caustic neutralizer
- HF ointment (calcium gluconate 2.5%)
- pH paper
- two pair of acid gloves
- two respirators with acid gas cartridges
- two pair of vapor-resistant goggles
- trash bags
- 5 gal. Haz-Mat bucket w/ National Fire Rating labels

If you have any other suggestions, please contact the MiRC staff.

![NFR Label](image)
III. “I’ve Spilled a Bottle of ----”

If you are the person responsible for the spilled chemical, clean up should be straightforward.

1. Did the chemical spill on you?
   - If the chemical is a strong acid or base, remove contaminated clothing and run the affected area under water for 10 to 20 minutes. This should relieve some of the pain and reduce the danger of severe burns.
   - If the chemical is HF, remove contaminated clothing and run the affected area under water for 15 to 20 minutes. Apply a liberal amount of calcium gluconate gel to the area, following the directions on the package. Seek medical attention as soon as possible.

2. Is the chemical hazardous?
If the chemical is hazardous and you feel you cannot handle it, alert others to its presence and evacuate the cleanroom. During the workday, notify MiRC staff. After hours, call the Georgia Tech Police (4-2500) first, then notify MiRC staff at: grover.mirc.gatech.edu/contactinfo.shtml
   - If the chemical is a solvent or possesses a strong odor, evacuate the bay and don a respirator and goggles before returning to clean up the spill.

3. Retrieve the spill response cart:
   - If the chemical is acidic or basic, don acid gloves, respirator and goggles before attempting to clean up the spill.
   - Isolate the area around the spill.
   - Select the proper equipment for the spill. For large spills, those from a half gallon bottle or larger, an absorbent dam will be necessary to prevent spreading. For small spills, only absorbent pillows are necessary. Select the proper neutralizer for the chemical (note: solvents do not require a neutralizer). View the video titled “Sharp Objects and Chemical Spills” at http://grover.mirc.gatech.edu/userservices/videos.shtml

4. Attack the spill:
   - If you are using an absorbent dam, place the dam around the spill, approximately 4 inches from the liquid.
   - Place the neutralizer bottle on the floor. Release the clamp and spray neutralizer, pushing the chemical into the spill dam. Be sure to cover the entire spill.
   - For the strong acids (HF and Sulfuric), you will need approximately an 8:1 ratio of neutralizer to chemical to completely neutralize the spill. The acid neutralizer will turn from purple to yellow to red when
finished. Check pH, it should be around 7. If still acidic, continue adding neutralizer until pH=7.

- For the strong bases (metal and ammonium hydroxides), you will need approximately a 6:1 ratio of neutralizer to chemical. The base neutralizer will turn from red to blue to yellow when finished. Check pH, it should be around 7. If still basic, continue adding neutralizer until pH=7.

- Once the reaction has ceased, allow liquid to cool. Check pH, it should be around 7. When cool, vacuum with the wet-vac cleaner.

- If you are dealing with a solvent spill, do not attempt to neutralize it. Soak up the chemical as soon as possible to avoid damage to the floor. Do not use water on the spill until after the chemical is soaked up.

5. Clean up:
   - **Do not remove your safety equipment until you have finished cleaning up. There may still be some active chemical on the floor.**
   - When the liquid has been completely absorbed, place the absorbent dam and pillows in a double trash bag.
   - If any glass is involved, place the glass in a separate Haz-Mat bucket and label it as “SHARPS” along with the chemical the glass contained.
   - Wipe down the spill area with the mop and DI water. When finished, place the mop head in a fume hood sink and rinse it thoroughly with DI water. Be sure to use the wet-vac inside the cleanroom to vacuum up the liquid. **Do not use any other vacuum.**
   - Place the bag in a Haz-Mat bucket and apply an NFR diamond label, writing the chemical on the label.
   - Put the lid on the bucket and place the bucket in the cleanroom storeroom. Notify MiRC staff to its presence.
IV. “I've Found a Chemical Spill”

Finding a chemical spill can be more dangerous than spilling the chemical yourself if the proper precautions are not taken. In most cases, the spill will be of a small amount of unknown chemical. In this situation, we assume that you do not know the identity of the chemical.

1. Assess any immediate hazards:
   - Is there a strong odor? If so, evacuate the bay and don a respirator before continuing.
   - Is a violent reaction taking place? If so, it may be wise to wait until the reaction has finished.

2. Attempt to identify the chemical:
   - Look for clues to the chemical’s identity: labels, tipped containers, etc.
   - Wearing an acid glove, use the pH paper to identify whether the chemical is an acid, base or solvent and its strength.
   - If the chemical can be classified as an acid or base with the paper but not identified, assume it is a very strong acid (HF) or a very strong base (Sodium Hydroxide).

3. Is the chemical hazardous?
   - If the chemical is suspected of being hazardous and you feel you cannot handle it, alert others to its presence and evacuate the cleanroom. During the workday, notify MiRC staff. After hours, call 4-2500 first and then notify MiRC staff.

4. Retrieve the spill response cart:
   - Don acid gloves and goggles before attempting to clean up the spill.
   - Select the proper equipment for the spill. For large spills, those from a half gallon bottle or larger, an absorbent dam will be necessary to prevent spreading. For small spills, only absorbent pillows are necessary. Select the proper neutralizer for the chemical. (note: solvents do not require a neutralizer)

5. Attack the spill:
   - If you are using an absorbent dam, place the dam around the spill, approximately 4 inches from the liquid.
   - Place the neutralizer bottle on the ground. Release the clamp and spray neutralizer, pushing the chemical into the spill dam. Be sure to cover the entire spill.
   - For the strong acids (HF and Sulfuric), you will need approximately an 8:1 ratio of neutralizer to chemical to completely neutralize the spill.
The acid neutralizer will turn from purple to yellow to red when finished.

- For the strong bases (metal and ammonium hydroxides), you will need approximately a 6:1 ratio of neutralizer to chemical. The base neutralizer will turn from red to blue to yellow.
- Once the reaction has ceased, allow liquid to cool. When cool, place absorbent pillows over the spill and allow them to soak up the liquid.
- If you are dealing with a solvent spill, do not attempt to neutralize it. Soak up the chemical as soon as possible to avoid damage to the floor. Do not use water on the spill until after the chemical is soaked up.

6. Clean up:

- **Do not remove your safety equipment until you have finished cleaning up. There may still be some active chemical on the floor.**
- When the liquid has been completely absorbed, place the absorbent dam and pillows in a double trash bag.
- If any glass is involved, place the glass in a separate Haz-Mat bucket and label it as “SHARPS” along with the chemical the glass contained.
- Wipe down the spill area with the mop and DI water. When finished, place the mop head in a fume hood sink and rinse it thoroughly with DI water. Be sure to use the wet-vac inside the cleanroom to vacuum up the liquid. **Do not use any other vacuum.**
- Place the bag in a Haz-Mat bucket and apply an NFR diamond label, writing the chemical on the label.
- Put the lid on the bucket and place the bucket in the cleanroom storeroom. Notify MiRC staff to its presence.
V. *First Aid*

First aid is an important element of cleanroom knowledge. The Microelectronics cleanroom environment contains many potential hazards, especially the chemicals we use. This section presents only a simplified first aid procedure for a hazardous chemical spill. For more specific information, consult the MSDS on line. [http://grover.mirc.gatech.edu/data/msds/index.phtml](http://grover.mirc.gatech.edu/data/msds/index.phtml)

1. Did the chemical spill on you?
   - If the chemical is a strong acid or base, run the affected area under water for 10 to 20 minutes. This should relieve some pain and reduce the danger of severe burns.
   - If the chemical is HF, run the affected area under water for 15 to 20 minutes and then apply a liberal amount of calcium gluconate gel following the directions on the package. Seek medical attention as soon as possible.
   - If the chemical is a solvent, rinse the affected area for 10-15 minutes to reduce any irritation.

2. The chemical spilled on someone else:
   - If the person is coherent, find out what chemical they were using.
   - If they are unable to tell you, have someone place them under a safety shower and remove contaminated clothing while you attempt to identify the chemical:
     * Look for clues to the chemical’s identity: labels, tipped containers, etc.
     * Wearing an acid glove, use the litmus paper to identify whether the chemical is an acid, base or solvent and its strength.
   - If the chemical can be classified as an acid or base with the paper but not identified, assume it is HF or Sodium Hydroxide.
     * Take necessary first aid action, including the use of HF ointment.
   - Notify emergency services at 4-2500 as soon as possible and then notify MiRC staff at grover.mirc.gatech.edu/contactinfo.shtml
CLEANROOM GOWNING PROCEDURE

http://grover.mirc.gatech.edu/userservices/gown.shtml/gown.shtml

I. Introduction

By far the dirtiest thing in our cleanroom will be the people who use it. Even the most carefully manicured person generates a shroud of particles from their skin, hair, clothing, and breath. Consequently, all cleanroom users must wear cleanroom garments which trap and hold the particles emitted by their bodies and clothing.

The Microelectronics Research Center has adopted the following gowning procedure for use in the Pettit Building Cleanroom. It is important that each person who enters the cleanroom carefully follow this procedure. There is a video on the website which demonstrates gowning and degowning.

http://grover.mirc.gatech.edu/userservices/gown.shtml

Frequent cleanroom users will be assigned a garment hanger. Their gown, hood and booties must be laundered approximately after every twentieth use. Infrequent users and visitors will not be assigned any hanger. Their garments should be placed in the “Dirty Laundry” bin in the cleanroom gowning area after each use.

A. **Clean shoes with shoe scrubber.** The shoe scrubber is located next to the gowning room entrance on the left. Turn the shoe scrubber on by pushing on the handle button. Slide each foot between the rotating brushes for several seconds. The scrubber will turn off when you release the button.

B. **Put on shoe covers located inside at the entrance of the gowning room.** Only flat or very low-heeled shoes may be worn. No sandals or open-toed shoes.

C. **Place hat, coat, and any other street garments not required for warmth and/or modesty in a locker.** The lockers are the last two on the left in the gowning room and are marked “Coat Closet”. Only combination padlocks issued by the MiRC are allowed on lockers. Any non-issue locks will be removed.
D. **Carefully put on a hood and cap.** The hood must completely cover your hair and ears. In addition, the bouffant cap is required for *people with long hair*. It should be worn under the hood.

![Bouffant cap](image1)

![Hood and face mask](image2)

E. **Remove your cleanroom garment from the storage cabinet and inspect.** The permanent gowns are stored on assigned hangers in HEPA filtered storage cabinets in the cleanroom gowning area. Take care to keep the garment completely off of the floor at all times. Inspect your garment each time you wear it for tears or soiling.
F. **Put on your cleanroom gown.** First, step into the gown legs, taking care not to let the garment touch the ground at any time. Then pull on the upper half of the gown and *zip it all of the way up*. While wearing a hood, be sure the “skirt” of the hood is completely inside the collar of the jumpsuit.

G. **Put on booties.** To put on cleanroom booties, sit on the gowning bench with your feet on the grey tile side of the bench. Put on one bootie and swing the “clean” foot to the blue mat. Then put on second cleanroom bootie and swing fully to the blue mat and stand up. Be sure the top of the boot is over the bottom of the jumpsuit leg so that any particles falling down the gown leg will be trapped in the bootie. **Note:** *Booties should never be worn in the gowning room, except for when you are standing on the blue mat.*
H. **Put on Cleanroom Gloves.** Carefully put on the first glove, touching the outside of this glove as little as possible. Put on the second glove using the previously gloved hand, taking care not to touch your skin with the gloved hand. Pull the cuff of the gloves over the sleeve of the jumpsuit so that any particles falling from your sleeves are trapped in the glove. Gloves should be worn at all times, no bare hands or fingers.

I. **Put on Goggles.** Before putting on your goggles, make sure to wipe them down with isopropyl alcohol, IPA. This will ensure that the goggles are free of any particles.

**II. Notes**

1. Cleanroom garments shall be worn only within the cleanroom complex, except under emergency conditions.

2. While in the cleanroom, keep your hands away from your face. The oils on your face can be transferred to the gloves and subsequently to the cleanroom equipment or your samples.

3. Do not wear soiled, dirty or lint-producing street clothes under cleanroom garments.

4. Do not hang street clothes or lab coats in the gown cabinets. Use separate “Coat Closet”.

5. Half finger glove liners are available to be worn under your gloves.

6. Facemasks are to be worn over the top of the nose.

7. Never open your gown in the cleanroom.
I. Disposal of Damaged or Non-Functional Equipment

Frequently, lab equipment stops working or gets damaged during normal use. Whenever something quits working, please give it to a member of the cleanroom staff, who will then either repair it or decide if it needs to be disposed of. Lab equipment is inherently expensive, and eventually much of the cost is passed on to the users. Therefore it helps everybody when we can avoid buying new equipment needlessly.

II. Broken and Uncleanable Glassware, Broken Wafers, Razors, and Other Sharp Objects

With all the glassware used in the cleanroom, obviously breakage will occur, or things will get contaminated beyond the point of being cleanable. If you find glassware meeting this description, please be sure to throw it into the container marked “Sharp Objects Only.” This also applies to the following materials: wafers, razor blades, needles, microscope slides and cover slips, and anything else that is questionable. Please be careful about this one: many poor, innocent co-ops have been stabbed by sharp things carelessly thrown into the regular garbage.

III. How to Make the Laundry Guy Happy

This one’s simple, but it really speeds up that painfully slow and boring job of doing the laundry. When you are finished with your gown, before you put it into the dirty clothes can, please zip it up and make sure it is not inside out. Also, please unfasten the booties from the gown and each other.
IV. Labeling Things When You Cannot Stick Around to Watch Them

Frequently, cleanroom users will need to leave things under the fume hoods overnight or for part of the day unattended. Our policy here is simple: Anything left unattended must be labeled with your NAME, PHONE NUMBER WHERE YOU CAN BE REACHED (not the number of any front office), WHAT IT IS THAT IS SITTING THERE, and the DATES AND TIME of when you left it AND when you will return to get it. All this can be filled out on the Chemical Warning Forms provided inside the cleanroom. If you do not use this form, your chemical(s) will be disposed of immediately.

![Chemical Warning Form](image)
V. Disposal of Solvent-and Photoresist-Soaked Materials

While many folks think of the solvents we commonly use as “safe, the fact of the matter is that they all can be dangerous if you get exposed to them enough. We have several containers in the cleanroom built specifically for the disposal of solvent-soaked materials, and require that they be used for the disposal of all such materials. While it may seem like a couple of TexWipes with photoresist on them is not that bad, just remember that the air in the cleanroom is constantly recirculated, so all those vapors will find their way back in eventually for everyone to breathe. The following materials should be put in the solvent cans:

- Any alcohols (ethanol, methanol, isopropanol, etc.)
- Acetone
- TCE (Trichloroethylene)
- Chlorobenzene (this stuff is particularly dangerous)
- Photoresist and related products

VI. What If I Do not Know How to Use Something, or If It Malfunctions While I am Using It?

If you need to use a particular piece of equipment and you are not absolutely sure how to use it, first of all, DO NOT TRY TO LEARN BY DOING IT!!! The staff is here to help you, and they can point you to the right person to show you how to do it. If something breaks during a process, tell the staff and they will take care of it. Above all, please DO NOT try to fix something on your own!! (There is a reason we do not keep the technical manuals inside the cleanroom....people actually have tried their own “repairs” before....we were not happy....)

VII. What Are The Procedures For Cleaning Up?

All cleanroom users are responsible for cleaning up their own mess. You should put away all tools, throw away all wipers and disposable items, and thoroughly clean all glassware. Make it look as though you were never there, or better yet, make it look better than it was before you were there. If you find a beaker that someone else left dirty, why not wash it while you are washing your own?

VIII. How Do I Store Things?

There are toteboxes/dryboxes available in the storage room for users to keep their belongings. Just be sure they are properly labeled.
IX. What If I See Someone Else Doing Something Wrong?

From time to time, people will have other things on their mind and unintentionally do something they really shouldn’t do. Most people don’t mind a friendly reminder now and then. It’s up to the users to keep the cleanroom operating smoothly, and as long as everyone cooperated then the chances of ruined projects, injuries, and problems in general are greatly reduced. If anyone has a problem with being politely told about something that may endanger somebody, tell the staff about it and we will take care of the problem.
The following describes proper cleanroom policies that users must follow at all times. Failure to do so is a violation, and the penalty for the violation is also listed below.

### Violation & Penalty

<table>
<thead>
<tr>
<th>Violation</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unlawful use of any cleanroom equipment without being an authorized user for the equipment.</td>
<td>Suspension from the cleanroom for three weeks.</td>
</tr>
</tbody>
</table>

### Proper Cleanroom Policy

- Every user operating any equipment must be authorized to use that equipment. In order to obtain an authorization to use equipment, a user requires to go through cleanroom orientation, training on the equipment, and a subsequent check off. This means, following the orientation, and being included in the list of authorized cleanroom users, a user needs to attend a training session on that equipment.

- Training sessions are held monthly. For more information on training, go to [http://cmos.mirc.gatech.edu/training](http://cmos.mirc.gatech.edu/training). If you want to use equipment, for which no formal training class is offered, contact MiRC Staff, and they can direct you to an experienced user.

- Once trained by an experienced user on the equipment, you should then schedule a time with your trainer to obtain a check-off. You can schedule a check-off only after a minimum of one week from the training. Doing so gives you time to get ready for check-off. Also, if you have other group members who are currently authorized to use that particular equipment, you can operate the machine under the constant supervision of the group member.

- Training videos on various equipment are also available on the MiRC web page at [http://grover.mirc.gatech.edu/equipment/video/index.shtml](http://grover.mirc.gatech.edu/equipment/video/index.shtml). However, watching these videos and obtaining peer-to-peer training in no way substitutes the quality of training obtained in the monthly training sessions.
When you are ready for a check-off, and the trainer is available, the trainer and trainee must meet up for a check-off session. The trainee must demonstrate his/her ability to use the equipment without any external assistance. If the trainer deems that the user is capable of using the system without causing any damage, he/she will grant access to the user, thereby making him/her an authorized user for the equipment. From this point on, the user can use the equipment without supervision. In cases where the trainer decides against granting access to the user, the trainer-trainee needs to schedule another check-off session.

- When you are ready for a check-off, and the trainer is available, the trainer and trainee must meet up for a check-off session. The trainee must demonstrate his/her ability to use the equipment without any external assistance. If the trainer deems that the user is capable of using the system without causing any damage, he/she will grant access to the user, thereby making him/her an authorized user for the equipment. From this point on, the user can use the equipment without supervision. In cases where the trainer decides against granting access to the user, the trainer-trainee needs to schedule another check-off session.

- No user can grant access to an unauthorized user to use equipment without his/her constant supervision. The authorized user must be present the entire time the other user wants to use that equipment.

- Authorized users are allowed to train other users on the equipment. They are responsible for any damage to the equipment caused by the other user, as it will be regarded as an act of negligence of the authorized user.

- A user is not allowed to use equipment without being an authorized user for the equipment (see Violation 1). He/She can only use the equipment under the full supervision of an authorized user (see Violation 2).

2

Granting access to an unauthorized user to use equipment.

**Penalty:**
Suspension from the clean-room for three weeks.

3

Using equipment with someone else’s buzz card without being an authorized user and/or not under supervision.

**Penalty:**
Suspension from the clean-room for three weeks.
Allowing an authorized/unauthorized user to run equipment under your name (i.e. using your buzz card), but without supervision.

**Penalty:**
Suspension from the clean-room for three weeks.

- No user can grant access to another user, authorized or unauthorized, to use equipment without his/her constant supervision. The authorized user who has buzz card access to the equipment must be present at the equipment the entire time the other user wants to use that equipment.

- The authorized user (buzz card holder) is allowed to train the other user on the equipment. The buzz card holder (the person whose card is being used) is responsible for any damage to the equipment caused by the other user, as it will be regarded as an act of negligence of the cardholder.

- A user is not able to login to any equipment reserved by another user for the first 15 minutes of the first hour the equipment is reserved. If the person who reserved it, does not show up in the first 15 minutes, any other authorized user can use the machine after that time.

- If a user's run exceeds his/her scheduled time, the next user who has reserved the equipment should reach a compromise with the previous user. The machine belongs to the user who reserved it, and it is entirely his/her decision to allow or disallow the previous user from using it.

- The user should however be careful in allowing the previous user to continue using the equipment, as he/she faces the risk of violating a cleanroom policy (see Violation 7). Also, after 15 minutes is up, if another user finds the equipment not in use, and begins using it, the machine belongs to this user. Therefore, if a user allows the previous user to use the equipment, he/she must log into the equipment after logging out the other user. The user should then be around the equipment to prevent Violation 4.
Using equipment when it is undergoing maintenance and is marked not to be used or "Machine Down".

**Penalty:**
Suspension from the cleanroom for three weeks.

- Under no circumstances is a user allowed to perform any maintenance on any equipment. Any abnormalities while using the equipment must promptly be reported to the MiRC Staff.

- When a machine is undergoing maintenance/repairs, users must be cooperative and patient. No user is allowed to use equipment in a non-workable state, or when it is undergoing routine maintenance.

---

**Scheduler Abuse I:**
Reserving equipment in the Scheduler, but not using the equipment for the time scheduled.

**Penalty:**
*First Offense:* Written warning. *Second Offense:* Unable to reserve that piece of equipment for one week. *Third and Subsequent Offenses:* Unable to reserve that piece of equipment for two weeks.

There will be no penalty if a user cancels his/her reservation before his/her scheduled time.

- The Scheduler system [http://grover.mirc.gatech.edu/servlet/Scheduler](http://grover.mirc.gatech.edu/servlet/Scheduler) allows users to reserve equipment inside the cleanroom. Some of the machines are booked 24/7. Due to heavy traffic for using the equipment inside the cleanroom, it is unlawful to reserve any equipment inside the cleanroom and not use it within the reserved time.

- Users must arrive at the equipment site promptly, as a delay of greater than 15 minutes will count as a "no-show".

- If a user realizes that he/she will not require using the equipment he/she reserved, the reservation must be cancelled before the hour it is reserved for. It is encouraged that users cooperatively share equipment usage time.
**Scheduler Abuse II:**
Using the equipment time of another user unlawfully.

**Penalty:**
Suspension from the clean room for three weeks for both users involved.

Absolutely, no compromises whatsoever.

- Users are not allowed to schedule equipment time for another user in their own account name. This means that, you should not sign up for equipment in your name with the intent of giving the time to another user, even though it is a member of your group.

- For instance, if the maximum time that the equipment can be scheduled for is 2 hours by each clean room user, then, two clean room users A and B cannot schedule for the equipment for 2 hours each, with user A intending to give up his/her time to user B. That is, after user B has used his/her total time of 2 hours, he/she cannot use the time of user A. If user A logs in and logs back out, and gives up the scheduled time to user B, both A and B are violating this policy.

- Users should not schedule for equipment time with no intent of using it. This includes scheduling for equipment for the same time every single day, and not using the time daily.

- **Note:** The maximum time that the equipment can be scheduled for varies from one machine to another. For some machines, within a 24 hour time frame, a user can sign up for as much time as is available within the day.

- Each equipment inside the cleanroom has a time limit, which is the maximum number of hours the equipment can be used in one session. No user should be logged in any equipment exceeding this time limit. This is to ensure that other users get the opportunity to use the equipment, and it is not being overused by a single user.

- If the equipment is not reserved by another user, you can continue to use the equipment. If you are exceeding the equipment time limit for usage, you should log out, and log back in. This resets the timer for the equipment login.

Being logged in equipment for longer than the equipment time limit.

**Penalty:**

*First Offense:* Written warning.  *Second Offense:* One-week suspension from cleanroom.  *Third and Subsequent Offenses:* One-week suspension from cleanroom each time.
Failure to log in at computer in the gowning room or not reporting in the logbook.

**Penalty:**
- **First Offense:** Written warning.
- **Second Offense:** One-week suspension from the cleanroom.
- **Subsequent Offenses:** One-week suspension from cleanroom each time.

**In addition,** a fine will be charged.

- All users must swipe their buzz card at the computer in the gowning room. If for any reason, the computer malfunctions, you have to report in the logbook located next to the computer.
- From the moment you enter the cleanroom until you are no longer using any equipment inside the cleanroom, you must remain logged in at the computer. If you are leaving the cleanroom, but are still using equipment inside the cleanroom, you should not log out of the computer.

Failure to log out from the computer in the gowning room or not reporting in the logbook.

**Penalty:**
- **First Offense:** Written warning.
- **Second Offense:** One-week suspension from the cleanroom.
- **Subsequent Offenses:** One-week suspension from cleanroom each time.

- All users must swipe their buzz card at the computer in the gowning room on leaving the cleanroom, provided you are not using any equipment inside the cleanroom. If for any reason, the computer malfunctions, you have to report in the logbook located next to the computer.
- From the moment you enter the cleanroom until you are no longer using any equipment inside the cleanroom, you must remain logged in at the computer. If you are leaving the cleanroom, but are still using equipment inside the cleanroom, you should not log out of the computer. When you are done with equipment usage, you should be sure to log out of the computer.
Not re-labeling properly with the correct color label every billing quarter.

**Penalty:**
Items mislabeled will be purged at the end of deadline.

Leaving chemicals without proper documentation in Chemical Safety Warning Sheets.

**Penalty:**
- a) The mislabeled chemical will be disposed of,
- b) Student will be issued a written warning,
- c) Repeat Offenders – One-week suspension from cleanroom.

- Each billing quarter consists of three months – beginning January, April, July and October. At the start of each quarter, users must re-label all their chemical bottles they wish to keep in the cleanroom storage cabinets and refrigerators.

- Users with dry-boxes and tote-boxes must re-label their boxes as well. The garment hanger labels also should be relabeled.

- The color of the label changes each quarter. Users are allowed to change the label-color of their items within a period of two weeks. Labels can be printed online from any computer at [http://grover.mirc.gatech.edu/userservices](http://grover.mirc.gatech.edu/userservices)

- The chemical labels print to the label-printer next to the computers inside the cleanroom, bay 4. The storage-box and garment labels print to the label-printer next to the computer in the gowning room.

- If a user does not have a dry-box/tote-box/garment hanger, but wants one, he/she can request for one at [http://grover.mirc.gatech.edu/userservices](http://grover.mirc.gatech.edu/userservices). Buzz card number, Scheduler ID and password will be needed to request any of these items.

- Chemical Safety Warning Sheets are available in a bucket in the hallway. You should fill it up properly by providing necessary information, such as, your name, contact info, removal date, and hazards of the chemical.

- If you do not find any of these sheets in the bucket, you can print one out online: [http://grover.mirc.gatech.edu/safety/chemicalwarning.pdf](http://grover.mirc.gatech.edu/safety/chemicalwarning.pdf).

- All chemicals left unattended must be properly documented by the use of these chemical warning forms. This includes everything, including water, which is left unsupervised at the fume-hood, hotplate, or any other location for any period of time.
Not wearing proper safety equipment at the fume-hood.

**Penalty:**
**First Offense:** Reminder to put on proper safety equipment.  
**Second Offense:** Written warning.  
**Third Offense:** One-week suspension from the cleanroom.  
**Fourth Offense:** One-month suspension from cleanroom.  
**Subsequent Offense:** One semester suspension from cleanroom.

Not showing up for cleanup.

**Penalty:**
Their account is suspended until they show up for cleanup and complete their cleanup duties.

Unauthorized entry into the cleanroom following another user.

**Penalty:**
Suspension from the cleanroom for three weeks.

Allowing a user to enter the cleanroom behind you when he/she has not swiped his/her buzz card.

**Penalty:**
Suspension from the cleanroom for three weeks.

- Safety equipment must always be used when handling chemicals at the fume-hood, or any other situation where you face the risk of injury.
- Normal cleanroom garment consists of a gown, hood, shoe covers, booties, mask, gloves, safety glasses and a bouffant cap (optional).
- In addition, when dealing with chemicals, a face shield and an apron must be worn at the fume-hood.
- When handling acids, acid gloves should also be worn.
- Cleanup is held almost every Friday and the scheduled time is 2 p.m. However, a user can perform cleanup any time before the Friday he/she is scheduled for cleanup.
- It is preferable to make up for cleanup before the time. Only in emergency situations, a cleanup will be rescheduled to a later date.
- Each user should swipe his/her own buzz card to enter the cleanroom level, and get in the gowning area. No one should follow another user into the cleanroom. This is to prevent the entrance of unauthorized users into the clean room.
- Be careful that no one follows you into the cleanroom without swiping his/her own buzz card. Each user should swipe his/her buzz card to enter the cleanroom level, and get in the gowning area. No one should follow another user into the cleanroom. This is to prevent the entrance of unauthorized users into the clean room.
Leaving your tote-boxes unattended.

**Penalty:**
- **First Offense:** Verbal warning.
- **Second Offense:** Written warning. **Subsequent Offense:** One-week suspension from the cleanroom.

Damage to equipment.

**Penalty:**
- The charges that the individual responsible for the damage will incur will be determined on a case-by-case basis.

Not following proper gowning and degowning procedures.

**Penalty:**
- **First Offense:** Demonstration of proper gowning and degowning procedures.
- **Second Offense:** Written warning. **Subsequent Offense:** One-week suspension from the cleanroom each time.

Removing supplies and/or equipment from cleanroom.

**Penalty:**
- Suspension from the cleanroom for three weeks.

- When a user leaves the cleanroom at the end of the session, his/her totebox and bottles must be put away at the proper place. The totebox should be put back in the right order in the cleanroom storage area. The chemical bottles should be returned to the appropriate cabinets. Acids in the acid cabinets in the cleanroom, bases and solvents in the cabinets in the storage area, and photoresists in the refrigerators in the cleanroom storage area.

- This does not apply if the user has to leave the cleanroom for less than 10 minutes, for example, a restroom break.

- Repairs of machine are the monetary responsibility of the individual if the machine broke down due to the user's obvious negligence.

- The charges that the individual responsible for the damage will incur will be determined on a case-by-case basis.

- Normal cleanroom garment consists of a gown, hood, shoe covers, booties, gloves, safety glasses, mask, and a bouffant cap (optional). They should be methodically worn as shown in the video with proper Cleanroom Gowning Procedures at: [http://grover.mirc.gatech.edu/us erservices/gown.shtml](http://grover.mirc.gatech.edu/us erservices/gown.shtml)

- You should not put your feet (with/without shoe covers/booties) on the bench in the gowning room at any time while gowning/degowning.

- **NOTE:** Safety glasses are mandatory.

- All the supplies of the cleanroom, such as the solvent squirt bottles, 4-inch boxes, and hotplates are for use only within the cleanroom. These supplies and equipment are exclusive for cleanroom-related research.

- Nothing should be removed from the cleanroom and taken for use in any other lab or department. The lack of supplies and equipment hinders other users from making progress in their research.
Changing the equipment settings.

**22**

**Penalty:**
Suspension from the cleanroom for three weeks.

Not leaving the cleanroom during emergency.

**23**

**Penalty:**
Suspension from the cleanroom for three weeks.

- The two general use computers are located in Bay 4 (center bay to the left, which houses the Plasma-Therm RIE, PECVD and Lindberg Furnaces). Users can surf the net only at these computers.

- The computers attached to any equipment are exclusively for equipment usage. It is only to be used for equipment applications. No one should use Internet or any other applications while using these systems.

- No additional software should be installed in any equipment as this violates equipment warranty.

- No one should modify any software settings in any system as this often leads to equipment malfunctions.

- During emergency, the emergency lights and/or siren will go off. The lights are located in visible places throughout the cleanrom. In such a situation, every user must immediately leave the cleanroom.

- Users should not take time to de-gown. They should leave the cleanroom while still wearing their cleanroom garments.

- Users must exit the building through the nearest emergency exit in an orderly manner. The emergency exits are printed on p.40 of this manual.
Pettit Building Cleanroom Facilities and Emergency Exits
Final Note

The intent of these policies and procedures are to ensure an environment where researchers can work together safely and productively while maintaining the integrity of the cleanroom environment and equipment. These policies and procedures will certainly change with time so please make sure your copy is up to date. Users are strongly encouraged to make suggestions on how we can more effectively meet our goals.