I. CLEANROOM PROCEDURES

A. ENTERING THE CLEANROOM
   1. Before working in the cleanroom, you must take the online Chemical Hygiene and Chemical Waste Generator training from DES and print out your scores on the quizzes for the lab manager. You can then receive the orientation training specific to MSAL from the lab manager.
   2. Make sure you are wearing the proper attire; this includes closed-toe shoes and long pants.
   3. Sign in with the time, your name, and the process you are doing and/or the equipment you’ll be using.
   4. Put on a lab coat (or the full coverall if you are wearing shorts), a hairnet, a beard cover (if you have facial hair), and goggles.
   5. Put on booties one shoe at a time. The proper sequence for this is: stand on linoleum, lift up foot, put bootie on foot, set foot down on sticky mat. Repeat with other foot.
   6. Put on gloves, and enter the cleanroom. Do not leave the door open for long periods of time.
   7. Only 5 people may be working in the cleanroom at the same time. Verify that there are not too many people in the cleanroom.
   8. Check your surroundings to see if everything is clean and in place. Check the solvent bottles if you’ll be working on the dirty/wet bench, so that they do not run out on you in the middle of the process.
   9. If you are the first person in the cleanroom that day (check the logbook), and if the bin of used cleanroom wipes on the dirty/wet bench is full, empty the bin into the trashcan. Similarly, if the Ziploc bag next to the spinner on the clean bench is completely full of photoresist-contaminated waste, seal the bag and put it in the trashcan. Make sure to put a new Ziploc bag (which can be found on the metal shelves) next to the spinner.

B. EXITING THE CLEANROOM
   1. Turn off all equipment you turned on. This may include: spinner, mask aligner, mask aligner lamp, vacuum pumps, DI water, bench lights, gas lines, probe station lamp, microscope lamp in the lithography area, monitor for the profilometer.
   2. If you must leave anything on for a long process (e.g. hotplate, furnace, ultrasonic bath), leave a note with your name, when you’ll be back, and any relevant contact information.
   3. Dispose of all chemicals used. (see Section I. D)
   4. Clean all surfaces. Make sure there are no wet spots on the benchtop, and wipe up any photoresist spills on the benchtop, in the spinner, or around the photoresist waste disposal bag.
   5. Put away your own materials in your storage cabinet.
   6. Check for stray napkins and throw them away.
   7. Exit the cleanroom. From the sticky mat, lift up one foot, remove the bootie, and step down onto the linoleum. Repeat for the other foot. Save your harnet in the sleeve of your labcoat. Discard your gloves and beard cover (if used), and put goggles in the bin.
   8. Sign out.

C. REFILLING PROCEDURES
1. **Photoresist**: Remove the large bottle from the refrigerator or freezer and allow to warm to room temperature overnight. Carefully pour into small bottle on the clean bench to prevent contamination. Wipe up any spills with acetone. Replace large source bottle in refrigerator/freezer.

2. **Solvent bottles**: Stocks of solvents are kept below the clean bench in the left cabinet. Make sure the chemical you select matches the squirt/spray bottle. Squirt bottles in the cleanroom are filled with solvents straight from the large bottles. Spray bottles of 70% ethanol should be filled with water and ethanol in the appropriate volumetric ratio.

3. If you finish a bottle (of solvent, of etchant, etc), rinse it thoroughly with water at least 3 times, deface the label (cross out the name with a permanent marker), and write “RINSED 3x” on the label, along with the date. These bottles may be recycled in the building recycling bin, or stored for future use as waste containers underneath the ultrasonic bath. Also, make sure to notify the appropriate person (in charge of either Chemical Orders or Chemistry Stores) if you notice a stock bottle is low or empty.

**D. CHEMICAL WASTE DISPOSAL**

1. First, know what you’re working with. Find the bottle that corresponds to the liquid you are using, bring it to the wet bench, and place the bottle in the sink. Remove the cap and set it aside. Place the funnel in the neck of the waste bottle, and carefully pour your waste in. Set your empty dish/beaker to the side (on a napkin if it is dripping), remove the funnel and place in the empty dish/beaker. Close the waste bottle, and return it to its bin. Thoroughly rinse both the funnel and your dish/beaker in DI water. Dry any cleaned dishes or beakers with a napkin, and return to bin.

2. If you create a new waste, obtain an empty, RINSED, 4L chemical bottle (stored under the ultrasonic bath). Get a green tag (found in the waste manager’s box in the cleanroom), and fill it out with the composition of the chemical with full chemical names (no chemical formulas) and percentages, which can be found in the MSDS. Tie the green tag securely to the handle of the bottle. Store the bottle in the appropriate gray bin in the Waste Accumulation Area.

3. If a waste bottle is full, submit your own waste pickup request (all Hazardous Waste Generator Trainees have learned how to do this and can submit requests), or notify the Waste Manager.

4. For TMV waste, refer to Biological Waste Disposal (Section II.A.1.). If the virus solutions are in the presence of hazardous chemicals, such as metals, acids, etc., address the solution as chemical waste and store in a waste bottle. When the bottle is full, dispose as a chemical waste.

5. Piranha should be allowed to cool for least one hour (for volumes larger than a Petri dish, a longer time must be allocated). After this period, the piranha may be disposed of in the appropriate waste bottle. While the piranha cools, cover it with another dish and label it with your name and the time you will return to dispose it.

**E. TRASH DISPOSAL**
1. Trash bags should be knotted and carried out to the dumpster behind the building; there, you will also find a recycling dumpster where you may put recyclables such as paper, flattened boxes and RINSED (and labeled as such) empty chemical bottles.
2. Extra trash bags are below the sink in the main lab, and in the 2nd to bottom drawer under the furnace in the cleanroom. If we run out, ask the maintenance staff to give you more; if you can’t find them in person, tape a note to the closet across the hall.

F. SPILL PROCEDURES

Note: Spills do not clean themselves! Never abandon a spill.

1. Small spills can be absorbed with a cleanroom wipe. It is a good idea to line the benchtop of the wet bench with cleanroom wipes, especially when pouring chemicals. Photoresist spills can be cleaned up with a cleanroom wipe soaked in acetone.
2. Large spills should be treated with the spill kit (in the shower or in the lab coat rack), which contains absorbent pads and booms. All cleanup materials should be treated as chemical waste and can be placed in the bags found in the spill kit. If you are uncomfortable with any spill, call DES at 5-3960.
3. HF spills should be treated with the HF spill kit, located in the shower. Burns should be treated with calcium gluconate gel, found on the dirty/wet bench, and also on top of the first aid kit in the shower. Read the SOP for working with HF before using it.

G. EQUIPMENT POINTERS

Note: Most of this can be found in the SOPs. Never use anything without having thoroughly read the SOP. It is also prudent to periodically reread SOPs to refresh your techniques.

1. Clean Bench
   a. Clean all spills as soon as they happen. Photoresist can be cleaned with a cleanroom wipe soaked in acetone.
   b. Throw away all trash (cleanroom wipes, extra foil).
2. Spinner
   a. Read the SOP for basic operation instructions.
   b. Line the entire bowl with aluminum foil, with a small hole for the spinner shaft in the middle.
   c. Make sure the entire surface of the spinner chuck is covered. Use blue tape or a carrier wafer if you need to, but never pour photoresist on the chuck if you can see the metal surface (photoresist goes down the vacuum line).
   d. Carefully dispose of photoresist-contaminated foil after you are finished. Lift the foil straight off the spinner without tilting it, and carefully form a ball; it helps to do this over a cleanroom wipe to catch any stray drips.
   e. Photoresist-contaminated pipettes and aluminum foil balls should be placed in the Ziploc bag next to the spinner. When this bag is full, seal it and put it in the main trash can.
   f. Wipe the metal surface of the spinner chuck with acetone to clean up any leftover residues. Check the inside of the collar that fits over the spinner shaft to verify photoresist has not accumulated in there.
3. Hotplates
   a. Be careful not to get any sticky materials (i.e. photoresist) stuck to the hotplate surface. If in doubt, tightly wrap the plate in aluminium foil.
   b. Always turn hotplates off when you are done. If you will be leaving them unattended during a long bake process, leave a note with your name, number, and when you’ll be back.

4. Mask Aligner
   a. Read the SOP for basic operation instructions.
   b. Always check the chuck alignment to the opening in the mask holder before loading your wafer.
   c. Perform an intensity check at least once a month, and record the results in the binder by the mask aligner.

5. Wet Bench
   a. Clean up all spills as soon as they happen. Wipe up any stray water droplets after you are done, so as to avoid confusion.
   b. Refill solvent squirt bottles if they are low (check before and/or after your lithography session).
   c. Thoroughly rinse all glassware, hand dry with a cleanroom wipe, and return to the gray glassware bin.
   d. When working with strong acids or bases, put on the extra personal protective equipment provided: face shield, rubber apron, neoprene gloves, and arm guards if necessary.
   e. Know the hazards of all the materials you work with; read the MSDS when in doubt.
   f. **Always** label chemicals used in glassware on the wet bench; put the dish or beaker on top of a napkin with your name, chemical name, and the date. If you are leaving it for an extended period of time, specify when you’ll be back and leave a contact number. Labeling chemicals at all times allows for emergency personnel to know exactly what you were doing in case of an emergency.

6. Ultrasonic Bath
   a. Before using, check the water level. If it is not at the line on the side of the tank (behind the rack with the holes in it), fill it up to the line with DI water.
   b. If the water is very dirty, drain the tank using the valve at the side. Remove the rack, and wipe the surfaces with cleanroom wipes. Refill with DI water only.