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Release Date by QSM: 2018-05-17 Review Cycle: As needed

Document History:

Version	Date	Revised sections	Description of changes
8.1	2018-04-27	IV (B) and (C), and V (D)	Emergency contacts were updated along with first aid kit location. PDMS is no longer in the forbidden materials list.
8.0	2018-01-19	All	Eliminated Appendix, added suggestions regarding guests, sample labeling, safety glasses procedure, PDMS restriction, gowning entrance procedure, and yellow/orange gas tower warning instructions
7.0	2016-09-07	All	New PI template, added rules on V.E (14) and (15).
6.0	2015-11-05	Added Section II(c), 3(d), 8(b), Appendix	-Added ID Badge Card Holder procedure. -Updated emergency contacts. Added in Section II(c) to inform Security whenever working at night. -Deleted the use of polyester suits for Weekly users. -Added Section 3(d)8(b) to watch your step when exiting the Air Shower. -Added the Safety Acknowledgement Form
5.0	2013-07-23	All	Updated to current INL document template.
4.0	2011-11-04	Section 4	Edited materials and actions that are not allowed, and modified section 4 in order to remove the use of disposable garments.
3.0	2011-08-08	Section 4.8, 7	Edited sections 4.8 on the Air Shower capacity, section 7 on waste disposal, garment replacement, escorting, pregnant women, and age minimum.

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2.0	2011-04-08	Various sections	Added pictures, deleted regulatory actions.
1.0	2011-03-08	All	First Release

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I. OBJECTIVE

The objective of the INL Nanofabrication Competence Centre is to offer internal and external customers a variety of micro- and nanofabrication solutions for both existing and emerging technologies, through various modes of services: consulting, research and development, co-educational, proto-typing and pre-production, technology transfer, and small-scale production.

To obtain access to the INL cleanroom, any user will first need to request a LIMS account (<http://lims.inl.int>) through which then license requests can be made to Cleanroom Access (00000001) to schedule all relevant training including Cleanroom Access and Chemical Safety training. Subsequently, license requests can be done to any equipment at various user levels depending on each particular system. |

II. SCOPE

This document is a guide and training tool for all cleanroom users to describe the gowning procedures when entering the cleanroom, the rules and expected behaviour while being inside the cleanroom, and the materials and actions suitable for a cleanroom environment. Understanding and complying with the guidelines described here will authorize access inside the cleanroom facility. The scope of this document excludes any type of operation or maintenance activity either general or tool-specific. |

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III. RESPONSIBILITY

The cleanroom access protocol document and training are dealt by the cleanroom Technical Staff.

IV. GLOSSARY AND REFERENCES

- A. **Chemical Hygiene Plan** is a collection of procedures to be followed when purchasing, handling, and disposing of chemicals. Introducing, carrying, or using any chemical inside the cleanroom requires prior authorization, training, inventory, and proper chemical documentation. Please refer to **CHEMICAL HYGIENE PLAN** training for any chemical or wetbench use.
- B. **Emergency Contacts**
 - 1. INL Internal phone Security Number: x-2500
- C. **First Aid Kits** are located in the Wet Process Bay and Cleanroom main exit.
- D. **Chemicals and Safety Showers:** the cleanroom has safety showers and eye wash systems to be used in case of an accidental chemical splash, even minor ones. These systems are located at the end of the main corridor and inside some of the bay areas where chemicals are being used.



Safety Shower and Eye Wash

- E. **Raised Floor:** the entire cleanroom floor consists of raised tiles, 60 cm from the main bottom floor. Occasionally these tiles are removed for maintenance purposes. When these tiles are removed, temporary signage for boundary

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identification is needed. Be alert of these signs to avoid tripping or falling into missing tiles.

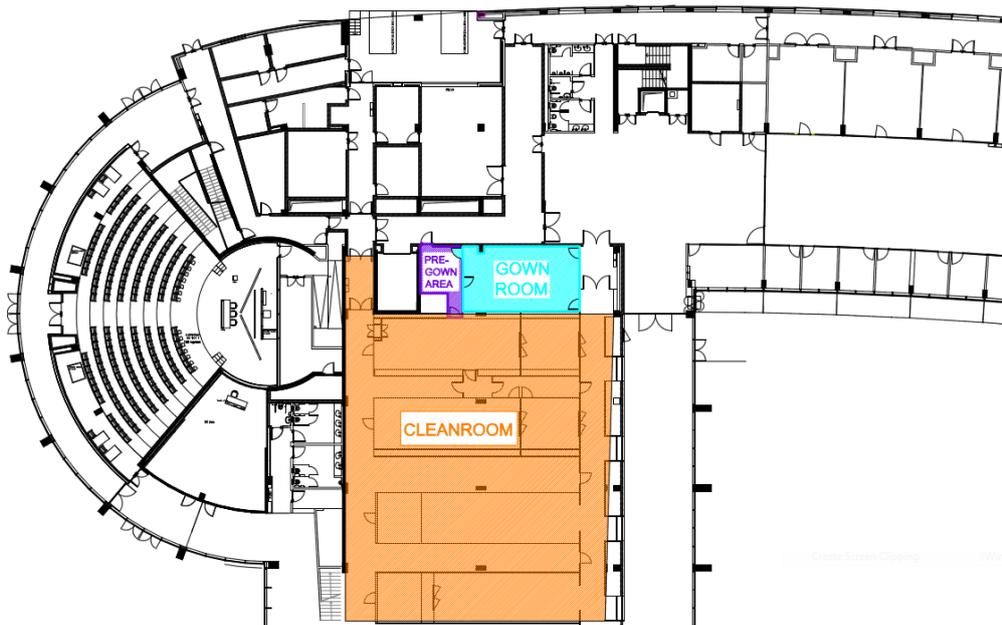
- F. Fire-hydrants and Water hoses:** Fire-hydrants and water hose enclosures are located throughout the main corridor, indicated by red signs.
- G. Alarm System and Emergency Exits:** Please refer to **INL Emergency Plan** document for a detailed description of building alarms and evacuation procedures.
- H. Gas Tower Alarm:** light indicator from the cleanroom gas alarm system located at the entrance and on cleanroom walls inside each bay and corridors. The red indicates an alarm; yellow or orange is a warning; and green is operational/OK. Users may enter the cleanroom with the yellow/orange warning, but it is not allowed to enter the cleanroom if the red alarm is on. **All users must evacuate the cleanroom immediately if the red alarm goes on.** This tower is not to be confused by the smaller towers connected to specific tools and equipment.
 
- I. Electrical Outlets and Tools:** Disconnecting any item from its electrical outlet is prohibited unless authorized by the tool's responsible person. The use of electric cord extensions is to be done merely temporarily, and not as a permanent installation. Do not touch any tools or machines without proper training and authorization from the tool responsible.
- J. Cleanroom hours:** Cleanroom working hours are 24 hours a day.
- K. Cleanroom Calendar:** The cleanroom is available everyday unless general maintenance is scheduled. For safety purposes, users should always be accompanied by a second authorized cleanroom user (buddy system). If working at night anytime from 18:30 to 9:00, please inform Security that you will be inside the cleanroom.
- L. ESD: Electro-Static Discharge,** which commonly occurs through human contact with sensitive devices or equipment, needs to be controlled by providing

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alternative routes to ground. Built-up negative charges on synthetic and other materials, along with positive charges which commonly accumulate on human skin may cause a sudden current to dissipate towards a low impedance path to ground to equalize potentials. This discharge can be detrimental to equipment and to devices.

M. **LIMS:** Laboratory Information Management System is an online tool used to book, log, view, and request information and/or training from each of the cleanroom tools and equipment. The address is <http://lims.inl.int>

N. Cleanroom Location (Entrance is through the Pre-Gown Area)



O. Cleanroom Floor Layout

Names of each bay:

Pre-Gowning / Gowning

Room

BIOLOGY

METROLOGY

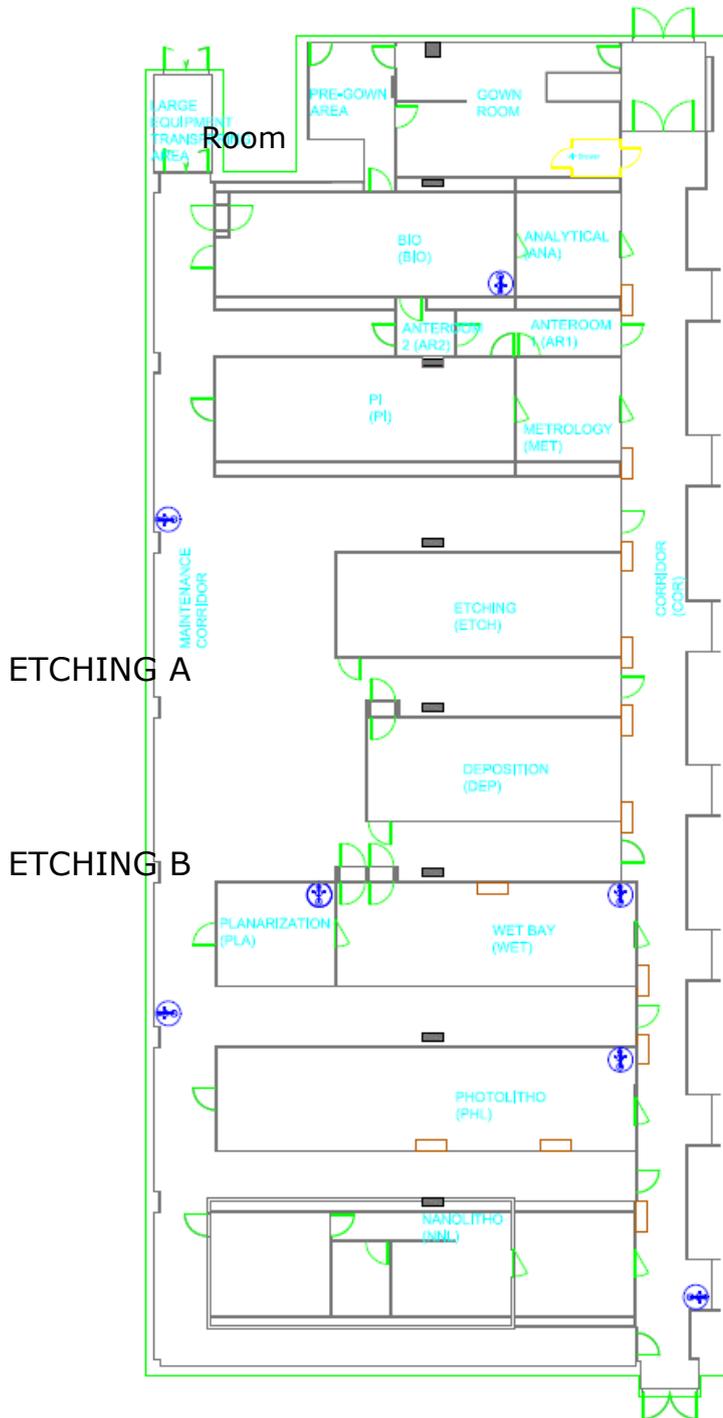
DEPOSITION AND

DEPOSITION AND

WET PROCESSES

PHOTOLITHOGRAPHY

NANOLITHOGRAPHY



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V. PROCEDURE

A. PRE-GOWNING ROOM PROCEDURE

1. Remove your coat/scarf before entering the gowning room.
2. Swipe your ID badge card to open the entrance door. Please have each person swipe their own ID card. Guests may enter only if escorted by an authorized cleanroom user.
3. Once inside the cleanroom pre-gown area, log into the Toggle User in Lab with your LIMS username, and press "Toggle".

Toggle User In Lab

Enter your username:

If you are bringing guests, enter the number during your logging and click "Save".

Please note that users are encouraged to request for support from the CR staff whenever more than two (2) guests are escorted inside the cleanroom. This will help with garment logistics and safety aspects of your visit.

After the toggle, you will see your name in the "Current users inside lab" list.

Toggle User In Lab

Enter your username:

Welcome Helder Fonseca!

You just signed in at 12:13.

Log attributes

Guests

Area

Current users inside lab (3)

User	Entry
Ricardo Silva	2017-12-13 10:24
José Rodrigues	2017-12-13 11:24
Helder Fonseca	2017-12-13 12:13

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4. Take one hairnet from the dispenser and put it on making sure all your hair is inside.
5. Take two shoe covers from the dispenser and put them on. If you have cleanroom shoes, you may use these instead of the shoe covers. If you are working with sensitive samples that require you to have ESD, use the blue covers with a black string. Place this string inside your sock so that it touches your skin.
6. On the wipedown table, place any items you will be bringing inside the cleanroom. Using the cleaning solution and wipes provided, wipe down the items and dispose the wipes. Use plastic liners for items that cannot be wiped.

B. GOWNING ROOM PROCEDURE

1. Step on the sticky-mat as you enter the Gowning Area.
2. Grab your existing suit, or a new cleanroom suit, hood, mask, and boots if you are a new user or if your used suit has been removed from your hanger for washing.

Escorted Guests or Visitors for one-day or less: Use Visitors' suits already opened and hanged. Use a new hood and mask. Locate the number for "visitor" hangers and boot boxes in the Hanger List.

Weekly Visitors for 1 to 3 days a week: Use new suits. Write your name on the numbered hanger list to identify your suit, boots, and safety glasses locations.

Cleanroom Staff and Daily Users have their initials identifying hangers, boots, and safety glasses compartments. Persons responsible for specific tools are also assigned a hanger.

3. Dress from the head down: Put on the hood, followed by the mask, and then the suit. The mask should be clipped to the inside of the hood. The hood should be tucked well inside the suit. Take care not to drag the legs of the suit on the floor.

*These garments are meant to protect the cleanroom from outside contamination (including contamination from humans such as hair, grease, saliva, eyelashes, etc).

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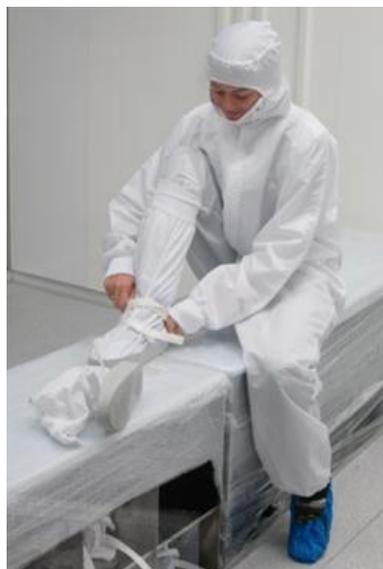
*These garments are not considered Personal Protective Equipment (PPE). If PPE is required for a specific task (e.g., apron, acid gloves, goggles, thermal gloves, UV eyeglasses), please refer to the respective procedure.

4. Inspect yourself in the mirror to make sure you have not missed any step up to now.



5. To put on each boot, sit on the bench and pass over each foot as you place the boot. Make sure that the soles of the boots touch the floor only after crossing the bench. Zipper, clips and two belts need to be adjusted over the suit leg for a proper fit of the boot up to the calf.

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6. If ESD is required for process reasons, use the yellow-sole boots over the ESD blue cover shoes with straps.
7. Once you are on the other side of the bench, put on the gloves. One should not touch the tip of the gloves while putting them on, in order to avoid contamination.
8. Put on safety glasses. These are assigned by user and stored in the rack with the same number as your hanger and boots. Do not remove these safety glasses from the Cleanroom.
When inside the cleanroom, always keep your safety glasses with you. You must wear your safety glasses to protect your eyes whenever you are performing or observing any of the following tasks:
 - Using a squeeze bottle to dispense a chemical
 - Cleaving a wafer or sample
 - Handling syringes or chemical media in any of the SUSS Tracks
 - Using glue
 - Using hot plates
 - Always wear safety glasses anywhere inside the Wet Process Bay
9. Test for ESD on the ESD tester if applicable.
10. Open the Air Shower door, enter and wait until the 12-second countdown is completed. Finally, manually open the following door to step inside the cleanroom.

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11. The Air Shower has a Reset push-button and an Emergency Off button (EMO).
 - a. The air shower has the maximum capacity of two people at the same time.
 - b. Watch your step as you exit the Air Shower through the second door.



Air Shower



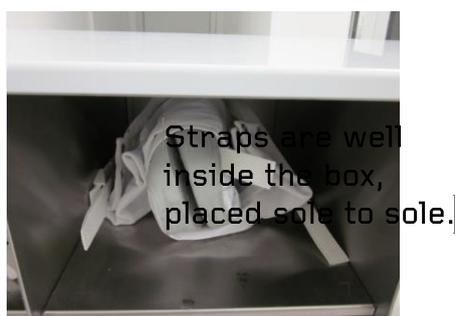
Display and Reset Push-Button

C. CLEANROOM EXIT

1. As you step into the gownroom to exit the cleanroom, remove your safety glasses and place them in your allocated compartment.
2. Remove your boots by sitting on the bench, making sure that the sole does not touch the floor on the other side of the bench.

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- Store boots inside your compartment, making sure the straps are well inside. Place both soles touching each other to avoid contaminating the bottom of the boot, and then wrap around the cloth and straps. **Please zip down fully your boot before removing it to avoid damaging the zipper.**



*Compartments are assigned by numbers, according to the name lists pasted on the walls.

- Remove your suit, hood and mask. Place them in your assigned hanger to reuse it next time. Place your mask and any other garment that is dirty inside the laundry containers for used suits. Make sure to separate the mask from the hood when disposing.
- Remove your gloves and dispose in the labeled waste bin.
- Step out of the gownroom, into the pre-gown area, and dispose your hairnet and blue shoecovers before leaving.
- At the computer, make sure you log out of the Toggle. You can associate your visit to a project if required, by clicking on "Edit Project" and selecting your project from the list.

Toggle User In Lab

Enter your username:

Helder Fonseca has been signed out!

From: 2017-12-13 11:26
To: 2017-12-13 12:13

Total time: 47 min.

Logged project:

29_Cleanroom (0028)

Current users inside lab (2)

User	Entry
Ricardo Silva	2017-12-13 10:24
José Rodrigues	2017-12-13 11:24

- Push the grey exit "Door Release" button on the wall and then open the door slowly to exit.

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D. MATERIALS AND ACTIONS THAT CONTAMINATE

1. Materials NOT allowed in the Cleanroom are:
 - a. Wood
 - b. Paper (unless it is cleanroom paper)
 - c. Cardboard
 - d. Foam
 - e. Pencils
 - f. Chalk

2. Additional personal materials and actions NOT allowed:
 - a. Chewing gum
 - b. Wearing Make-up
 - c. Food
 - d. Drinks
 - e. Torn apparel

3. Actions prohibited in the Cleanroom:
 - a. Cleaving wafers or glass outside the designated area (which is the table at the entrance of "Deposition and Etching B" Bay).
 - b. Tearing any type of paper or wipes (regardless if it is cleanroom paper)
 - c. Impeding laminar flow by blocking airways or walking fast.
 - d. Exposing hair
 - e. Drinking water outside the Water Fountain area.

E. RULES, BEHAVIOUR, AND DISCIPLINE

1. Passing through large objects into the cleanroom:
 - a. Large objects that cannot be introduced with you into the cleanroom gownroom will need to be transferred through the Transferring Area located next to the Cleanroom Entrance and Elevator. This area separates the Cleanroom Grey Area from the outside hallway. Before entering this area, objects will need to be removed from their boxes and/or outside wrapping.
 - b. Once inside this area, the double doors need to be closed. Both sets of double doors should not be opened simultaneously in order to minimize contamination that may enter the cleanroom grey area during this transferring process.
 - c. The objects will need to be wiped with an IPA/Water solution once inside this area.

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- d. Finally, a cleanroom gowned person may then move the wiped object inside the cleanroom grey area through the second double doors.

2. Wearing proper apparel:

- a. The gowning garments need to remain tucked and clean to avoid contaminating the cleanroom with particles from the outside environment.
- b. If any garment or glove is torn or dirty, it should be replaced immediately.
- c. After 40 hours of use, or one week of use, all garments should be placed in the assigned bins for washing. Masks, due to constant contact with one's mouth, should be replaced daily.
- d. The use of gloves and masks is obligatory at all times to avoid saliva or grease to contaminate the cleanroom.
- e. Cleanroom garments and gloves are not to be used as personal protective equipment, especially when handling hazardous materials.
- f. It is not permitted to open cleanroom coveralls inside the cleanroom (e.g., carry mobile phones outside if you plan to use it, and please wipe it down before entering).
- g. Never wear jewelry outside the cleanroom garments (or any items that may get tangled with a tool).

3. Maintaining surfaces clean:

- a. Avoid touching your face with the gloves, as these will get contaminated with face grease which can then be passed on to other items inside the cleanroom.
- b. Change gloves regularly.
- c. If you touch the floor, your face, or any part of the equipment that may be dirty, gloves will need to be replaced.
- d. Verify continuously that the gloves are clean and undamaged.

4. Work in Progress and Storage

- a. All samples, both from internal and from external services, must be labeled with the user's name, date, and preferred sample code. It is suggested the following format: Group/UserID_ProcessName-Run#_Date.
- b. Items/samples/wafers which are unidentified, uncovered, and/or disorganized should not be left neither on any cleanroom surface nor storage. These might be disposed without prior notice.
- c. If you need storage space, please ask a member of the Cleanroom Staff to allocate one for you.

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5. Maintaining discipline, organization, and proper laminar airflow:
 - a. No running is allowed inside the cleanroom.
 - b. Do not leave objects in the middle of the hallway or in areas where the laminar flow may be impeded.
 - c. Never block safety equipment or doors.
 - d. Keep aisles clear and free of tripping hazards.
 - e. Every item has its home. When borrowing materials such as tweezers or screwdrivers, please make sure to return these to their home as soon as possible.
 - f. Kindly notify people if you observe them behaving inappropriately according to INL's cleanroom rules. Likewise, receive comments from other users and INL's staff in a positive and constructive way.

6. If regular paper needs to be brought inside the cleanroom, a clear folder should be used.

7. Solid Waste Disposal: Dispose items only in the special containers allocated for each specific material.
 - a. Chemically-contaminated materials have a designated container. No liquids shall be disposed into the solid waste bins, except in the case of damp cloths or paper. Special chemicals, such as EKC, have specific solid waste containers which should not be used for any other chemical.
 - b. Solid and sharp materials also have specially allocated containers to protect cleaning personnel when handling these bags.
 - c. Urban waste bins: any other non-hazardous, non-contaminated solids shall be disposed as urban waste.

8. Drinking water is available at the entrance of the Cleanroom. You may drink water only from the fountain provided and only within one (1) meter from this fountain. Gloves should be clean prior to handling the fountain. Do not use drinking cups for any other activity.



Water Fountain

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9. Escorting Guests: Any authorized user may escort guests, making sure all rules mentioned in this document are followed and accompanying them at all times.
10. Grey Area: This area is meant to be accessed only by maintenance personnel or expert tool users.
11. If power/lights go out: please safely stop any activity and proceed to the gownroom area. During an emergency, proceed to the nearest exit.
12. Avoid entering the cleanroom if you are sick.
13. Pregnant women should avoid going in the Biology, Photolithography, and Wet Process Bay.
14. Any procedure or tool to be used inside the cleanroom will require Training, Certification, and Authorization from the tool responsible.
15. All tool activity should be logged in LIMS.