CNI LABS ANNUAL
CLEAN ROOM USER’S MEETING 2022

Presented by The CNI labs staff

March 2022
Columbia University
Emergency services and Lab phones

- EHS: 212-854-8749
- Campus Emergency (Public Safety): 212-854-5555
- x99 (From a campus phone)
- Fire Alarm command center: 212-854-3204

<table>
<thead>
<tr>
<th>Lab/Office</th>
<th>Location</th>
<th>Number</th>
<th>Contact person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean room back end bay</td>
<td>CEPSR 1052A</td>
<td>3-1551</td>
<td>James Vichiconti</td>
</tr>
<tr>
<td>Clean room litho bay</td>
<td>CEPSR 1052A</td>
<td>3-1552</td>
<td>James Vichiconti</td>
</tr>
<tr>
<td>Clean room furance bay</td>
<td>CEPSR 1052A</td>
<td>3-1553</td>
<td>James Vichiconti</td>
</tr>
<tr>
<td>Labs Senior Director office</td>
<td>CEPSR 1015</td>
<td>4-9927</td>
<td>Nava Ariel-Sternberg</td>
</tr>
<tr>
<td>Clean room office</td>
<td>CEPSR 1017</td>
<td>1-5688</td>
<td>Youry Borisenkov/Mike Maghiar</td>
</tr>
<tr>
<td>CNI Research operation</td>
<td>CEPSR 1010</td>
<td>4-4657</td>
<td>Melody Gonzalez</td>
</tr>
<tr>
<td>SMCL Director office</td>
<td>Havemeyer 544</td>
<td>1-9413</td>
<td>Phil Chow</td>
</tr>
<tr>
<td>EM Director office</td>
<td>Havemeyer 115P</td>
<td>3-1285</td>
<td>Amir Zangiabadi</td>
</tr>
<tr>
<td>TEM lab</td>
<td>Havemeyer 116</td>
<td>3-0415</td>
<td>Amir Zangiabadi</td>
</tr>
<tr>
<td>Nanobeam lab</td>
<td>NWC 705</td>
<td>4-0576</td>
<td>James Vichiconti</td>
</tr>
<tr>
<td>Clean room Director office</td>
<td>CEPSR 1020</td>
<td>4-9831</td>
<td>James Vichiconti</td>
</tr>
</tbody>
</table>
CNI labs overview
<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Nava Sternberg</td>
<td>Senior Director of the CNI Labs</td>
</tr>
<tr>
<td>James Vichiconti</td>
<td>Director of Clean Room</td>
</tr>
<tr>
<td>Dr. Phil Chow</td>
<td>Director of SMCL</td>
</tr>
<tr>
<td>Dr. Amir Zangiabadi</td>
<td>Director of EM Lab</td>
</tr>
<tr>
<td>Dr. Youry Borisenkov</td>
<td>Clean Room Process expert</td>
</tr>
<tr>
<td></td>
<td>Clean Room Engineer</td>
</tr>
<tr>
<td>Mike R. Maghiar</td>
<td>Labs Equipment Engineer</td>
</tr>
<tr>
<td>Melody Gonzalez</td>
<td>Research Operation Assistant</td>
</tr>
<tr>
<td>Dr. Christine McGinn</td>
<td>Part time cleanroom Engineer</td>
</tr>
</tbody>
</table>

Clean Room User’s Meeting 2022
Clean Room guidelines review
Entering the lab

**Allowed:**

- Staff-approved chemicals/materials
- Cleanroom-compatible paper/notebooks
- Wiped-down laptops and cell phones
- Staff-approved guests

**Never Allowed:**

- Unauthorized electrical equipment (e.g. hotplates)
- Cardboard and standard notebooks
- Un-authorized guests
- Food and drink
- Make up
Entering the lab: attire/accessories

Prohibited attire
- Shorts/skirts
  (must be long pants)
- Sandals/flip-flops
  (must be close-toed shoes)
- Make up
  (particle and stain risk)

Prohibited accessories
- Umbrellas
- Jackets
- Bags/purses

Daily use lockers available in lounge room #1014
(swipe access granted after orientation)

Remove belongings by end of day!
Entering the lab: Gowning

- Before entering gowning room:
  - Shoe covers
  - Hair net
  - Beard cover (if applicable)
  - Face mask optional (clean disposable masks are available in gowning room to replace your mask or as a second layer)

- Claim a hanger: use a name tag to claim a hanger
  - Do not use someone else’s coverall or hangers
  - Inform staff if name tag is missing
Entering the lab: Gowning

- **Cleanroom suit:**
  - Face mask (optional)
  - Hood (tucked into coverall)
  - Coverall (tucked into shoe covers)
  - Shoe Covers
  - Tool belts (optional) can be purchased at Clean room office

- **Safety Glasses**
  - Alcohol wipes available for cleaning

- **Nitrile/Latex gloves**
  - Prevents clean room/sample contamination
Entering the lab: Gowning

Gowning notes:

- Do not allow your cleanroom garments to drag on the floor.
- Don’t step on the shoe covers.
- Dispose of gloves inside the gowning room.
- Dispose of hair net, beard and shoe covers outside of the gowning room.
- Store cleanroom coverall and hood on your designated hanger.
  - If no free hangers or name tag missing, place used garments in laundry basket and inform staff.
- Cleanroom shoe covers should be placed in the in-use shoe cover rack.
- The Cleanroom staff removes the garments weekly for cleaning.
Lab inventory for purchase

- Clean room notebooks
- Tweezers (metal and plastic tip)
- Wafers: silicon, quartz, sapphire, SiC
- Dicing saw blades (non-standard)
- 5” Photomask Blanks (Cr/glass or quartz)
- Sample boxes: full wafers and chip trays
- Tool belts
Clean Room safety
Safety

- The CNI Cleanroom is a nanofabrication facility that contains corrosive, toxic and flammable materials. Safety is paramount!

- No entry for unauthorized personnel.

- Each user must swipe their university ID upon entry.

- Upon entry: locate the clean room’s emergency exits, safety showers, and eye wash stations (reviewed at cleanroom orientation).
Mandatory safety training for access:
- Lab safety training class (TC0950)
- Hydrofluoric acid (HF) training (TC1650)
- COVID 19 safety training

Your access will expire at the next safety credential expiration date. To avoid losing access renew training on time and send us the updated certificates asking to extend your access.

New users must then attend the clean room orientation (given weekly and limited to 2-3 users per week).
Working Alone and After Hours Policy

- **Normal hours:** Mon-Fri / 7 AM-6 PM

- **After-hours:** Mon-Fri / 6 PM-7 AM
  + Weekends & University holidays

Working alone during *normal operating hours* is an acceptable practice.

While alone in the lab, maintain phone contact with someone nearby, outside of the laboratory.
Working Alone and After Hours Policy

- After-hours policies:
  - No toxic gas flow allowed from 9PM – 7AM (affects Cl-RIE, PECVD, Furnace).
  - No HF handling allowed. Contact staff if you need to use designated automatic stations and need assistance in preparing HF bath.
  - Buddy system: Afterhours work requires a certified clean room user with a valid C14 and afterhours access to act as a buddy. Specify your buddy in the process tab in Badger.
  - C14 renewal takes 8-10 weeks – plan ahead.

Normal hours: Mon-Fri / 7 AM-6 PM
After-hours: Mon-Fri / 6 PM-7 AM + Weekends & University holidays
Alarms – Do not enter the floor if alarms are going off

- **Blue lights**: local hazardous gas event.  
  **Exit** the lab and go to the 10th floor lounge.  
  ➤ You may leave after accounting for yourself w/ staff/public safety.

- **White lights**: fire, thermal or smoke event.  
  **Exit** building immediately.

- **Blue & White lights**: ambient gas/thermal event triggered by TGMS.  
  **Exit** building immediately.  
  Meet at W 120th St. level  
  ➤ You may leave after accounting for yourself w/ staff/public safety.

Update your cell phone number on your Badger profile.
Safety: R.A.C.E. & P.A.S.S.

In case of fire: **R.A.C.E.**
- **R**escue – Persons from immediate area.
- **A**larm – Pull alarm box located by exits.
- **C**onfine – Close doors as you leave.
- **E**xtinguish or **E**vacuate.

To use a fire extinguisher: **P.A.S.S.**
- **P**ull the pin.
- **A**im at the base of the fire.
- **S**queeze the handle.
- **S**weep back and forth.

**Evacuation**
Use stairs or move to adjacent building.

**DO NOT USE ELEVATOR**

Meeting location is W 120th Street-level Entrance to CEPSR
Safety: Chemicals policy

- All user chemicals must be approved by the clean room staff!
  - Chemical approval procedure:
    - Familiarize yourself with the chemical SDS (Safety Data Sheet).
    - Email cniCR@lists.columbia.edu with intended process relevance & chemical SDS (for chemicals database).

- All approved factory chemical bottles in clean room must have a Columbia bar code on the container with the clean room as the destination storage place.

- Always use open chemical bottles before opening a new bottle.

- SDS Reference (CU login through EH&S website): [https://research.columbia.edu/content/safety-data-sheets](https://research.columbia.edu/content/safety-data-sheets)

---

Not cool..
Safety: Chemicals labeling policy

- All user chemical containers must be labeled:
  - Chemical name
  - Your full name
  - “In use date” (the date the chemical first placed in service)
  - Your group (PI or company)

- Unclaimed chemicals found exceeding one year of the “in use” date will be disposed of.

- All chemical containers must be self standing.

- Do not leave unattended chemicals inside the hood for more than a day. Notify cleanroom staff member if needed.
Safety: Chemical storage

- All chemicals must be stored in the appropriate storage containers and in appropriate cabinets.

- Do not store different classifications of chemicals in the same storage container:
  - Flammables cannot be stored together with Oxidizers.
  - Acids cannot be stored with Bases.
  - Chemical inventory is posted on the cabinet doors.
Safety: Working with chemicals

- Only work with chemicals inside **designated fume hoods** (including IPA). Training is required for all wet stations.
- Fume hoods must be reserved and enabled/disabled through Badger.
  > Wear appropriate personal protective equipment: Apron, Face shield, Protective Gloves (on top of latex/nitrile gloves)
- Pressure test gloves for holes prior to use.
  > Change gloves after each use.
- Do not block the fume hood’s air holes including those on the work surface.
- Keep chemicals separate. Do not introduce solvents/bases into acid fume hood or acids into solvent/bases fume hoods.
- Do not pour HF containing mixtures in glass containers
- Glassware: rinse after use with DI water 3x and place in dish washer (in litho room).

Some chemical baths are staff-prepared for convenience and safety
Safety: Chemical exposure (eye)

- Remove contact lenses (not recommended at all in the lab) and/or protective eyewear and locate nearest eyewash station.

- Activate eyewash in hands-free mode.

- Flush with water using eyewash *immediately* and rinse for at least 15 minutes (ask for help from another cleanroom user).

- Seek medical care as soon as possible!

- Keep others informed of your situation.

- Backup eyewash squeeze bottles are available in litho area.

Reference:
Columbia University: *Provision, Use and Maintenance of Emergency Drench Equipment in Laboratories* (Procedure 5.07 v1.0)
Safety: Chemical exposure (skin)

- **Immediately** remove contaminated PPE/clothing and proceed to nearest emergency shower station in case of suspected chemical exposure to skin.
  - Shower curtains are available for privacy if needed.

- Alert others nearby about the possible emergency.

- Activate emergency shower/eyewash and flush the affected area **for at least 15 minutes.**

- Seek medical care as soon as possible!

- **IMPORTANT:** cleanroom suits, head/shoe covers, standard gloves will not protect you from chemical spills.

Reference:
Columbia University: *Provision, Use and Maintenance of Emergency Drench Equipment in Laboratories* (Procedure 5.07 v1.0)
Safety: Chemical exposure (hydrofluoric acid)

- Hydrofluoric acid (HF) exposure may not cause immediate sensations or visible symptoms, but can be fatal.

- In the case of suspected HF skin exposure:
  - Alert staff and other users.
  - Remove contaminated clothing and proceed to emergency shower.
  - Flush exposed area with water for 5 minutes. While flushing, ask another user or contact to call emergency services.
  - Open HF Treatment Kit in gowning room and corrosives bay.
  - Apply generous amount of calcium gluconate cream to exposed area. Eye drops are available for eye exposure.
  - Take the laminated SDS or the EH&S “Print and Go” sheet and the antidote with you to emergency services.
  - If for some reason calcium gluconate cream is not available continue to flush until first aid is available.

- In the case of suspected HF inhalation:
  - Alert staff and other users to call emergency services.
  - Await emergency services in clean air.

Reference:
Hydrofluoric Acid EH&S policy Procedure 5.08/version 2.1
Safety: Chemical waste handling

- Never hold containers by the cap.
  - Hold chemical and chemical waste bottles with both hands using the handle.

- Chemicals should not be poured into the drain.
  - Waste chemicals are collected in designated containers for disposal provided by staff.
  - Remove funnels when done pouring waste.

- Never fill waste bottles beyond 2/3 of their volume.
  - Inform staff if the waste bottles are full/missing.

- Allow heated chemical waste to fully cool before disposal (e.g. piranha).

- Waste containers must always be stored in designated cabinets.

- Add only the compatible chemicals to the corresponding waste container.
Clean room equipment policies review
Etiquette

- The clean room is a shared workspace.
  - Please be mindful and considerate of other users.
- Always leave tools in a pumped-down/standard operating status ready for the next user.
- All tools must be reserved in order to be used. Respect the reservation schedule and policies.
- Cancel reservations you no longer need so others may use the time.
- Clean your materials, tools, chemicals, and equipment up when you are finished with your work.
- If something broke – let us know.
Etiquette

- Do not use others’ labeled glassware, tweezers, tools, chemicals, Badger sessions etc.....

- Please comply to materials restrictions on specific tools. The wrong materials in a tool can potentially destroy someone else’s research.

- Respect superusers, staff, and other users. We are here for you!
General policies

- It is **not recommended** to use your cell phone while working in the clean room unless it’s an emergency or you need to report problems.

- The clean room phone numbers are:
  - 212-853-1551
  - 212-853-1552
  - 212-853-1553

- Do not enter core spaces – these are for staff only.

- Do not check your email or open browsers on equipment computers.

- Do not modify equipment or attempt to fix tool problems by yourself.
While using tools...

- Only use tools that you have been certified to use.
  - 300 days of not using some tools will lead to recertification. Enabling and disabling them for one minute doesn’t count…

- Do not leave non-certified users alone with a tool.

- Enable tools in Badger prior to use.

- Always follow tool SOPs and training guidelines.
  - SOP does not replace training or certification. It’s always better to ask.

- Report all equipment problems through the Badger laboratory management system.
  - Reporting a problem will not bring the tool down but it will make the tool orange in Badger and the comment/problem will be viewable by other users. Only superusers and staff can determine whether or not to bring a tool down.

- Tool logbooks must be filled out for each user session when required.

- Always disable the tool in Badger when finished.
  - Email staff if you forget.
Lithography: hoods

**Rules reminders:**

- Keep photoresist waste contained
  - Always line spinners
  - Solid waste jars in fume hoods now available to prevent floor spills.
- Do not take resist bottles out of the clean room.
  - New resists require staff approval.
- Please be aware of the correct spinner resist classification allocation.
  - Miscellaneous spinner available for non-standard materials.
- Contamination & resist quality:
  - Small bottles are available to prevent contamination of main bottles.
  - Change gloves and keep notebooks/phones out of resist areas.
- Chemical availability:
  - Inform the staff if heavy chemical usage is planned
  - Inform staff if certain photoresist is running low.
  - *As of 2020*: 6%-HSQ and ZEP 520A (request only)
Lithography: Mask Aligners

- **Rules reminders**
  - Always use UV-protective eyewear, located in cabinet.
  - Chuck slides on aligners should be handled carefully and never left pulled out.
  - Always report audible alarms during exposure via Badger.
  - Fill in the online Google logbook (it helps us keep track of resist use and exposures).

- **2022 updates:**
  - New enhanced-DUV arc lamp type are in use.
  - ‘Drop-in’ ND filters are available to use.
Material restrictions:

- Fluorine-Reactive Ion Etcher (F-RIE):
  - CMOS-compatible materials and standard resists only
    - Cr, W, Pt
    - Al, Ti, Pd - Allowed but must be covered during entire etch
  - Never Allowed:
    - High vapor pressure materials: Pb, In, ITO, etc,
    - Au, Ag, Cu
    - Glasses/microscope slides (fused silica, quartz, sapphire only)
    - III-V materials
    - Li-containing compounds
    - No PMMA
Material restrictions

- RCA and LPCVD Furnaces:
  - Tubes 1, 3, and 4: CMOS-compatible materials and standard resists only. **No metals.**
  - Tube 2: open to metals. Please make sure to use appropriate accessories.
Badger operations review
Each user should have their own Badger account even when the staff is performing work for them. Students from the same lab cannot share passwords.

All New Users should provide a full account form signed by their PI or admin.

Users should stay in “enable” stage for the entire use session to prevent billing mistakes and issues. Don’t forget to disable when you’re done with your work.

Litho hoods (other than spinner work) should be enabled and disabled once in order to create a flat charge.

If you accidentally enable the equipment and disable it immediately, you will be charged for the minimum charge. In order to avoid this unnecessary charge please send an email to cleanroom staff and they will fix it.
Badger: generating activity report

1. Reports → Financial Details

2. Select the dates → Display

3. You’ll get a report with all your usage and the cost
Mark the machine, go to "Equipment Actions" and "Report Problem" or "Make Comment". Record your comment in the window that opens.

To view a comment or a problem, mark the machine, go to Maintenance tab and click on “Show Message”.

Badger: reporting/viewing tool problem
Badger: adding cell phone number

1. Go to “Window” and “Resource”
2. Search for yourself
3. View member information
4. Type in your cell phone number