

# CLEANROOM ORIENTATION

**UNLV**

SCIENCE AND ENGINEERING BUILDING

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# OVERVIEW

- What is the Cleanroom?
  - Purpose
  - How the Cleanroom stays clean
- Cleanliness class
- Types of contamination
- Operating Procedures: Pre-entry Protocol
- Entrance courtesies
- The Need For Gowning
- Cleanroom Garments
- Gowning Procedures

# OVERVIEW

- Proper Behavior in the Cleanroom
- De-gowning Procedures
- Utility Chase Entrance Procedure
- Support Equipment
  - Wet Benches
  - Specialty Gas Hook-ups
  - Chillers

# OVERVIEW

- Emergency Protocol
- Emergency Equipment
- Safety Equipment (PPE)
- Spill Response Procedures
- Policies and Procedures Enforcement
- Cleanroom Penalties

*This orientation is only a supplement for the SEB Cleanroom Manual. It is no substitution for the Cleanroom Manual. Please see the Cleanroom Manual for more information and details.*

# WHAT IS A CLEANROOM?

- ❖ Sealed room in which the concentration of airborne particles is controlled to specified limits.
- ❖ Need to eliminate contaminants generated by people, processes, facilities, and equipment
  - ❖ Contaminates need to be continually removed from the air.
  - ❖ The level to which particles must be held to a minimum depends upon the standards required by the facility and the processes undertaken within the facility.



# PURPOSE OF A CLEANROOM

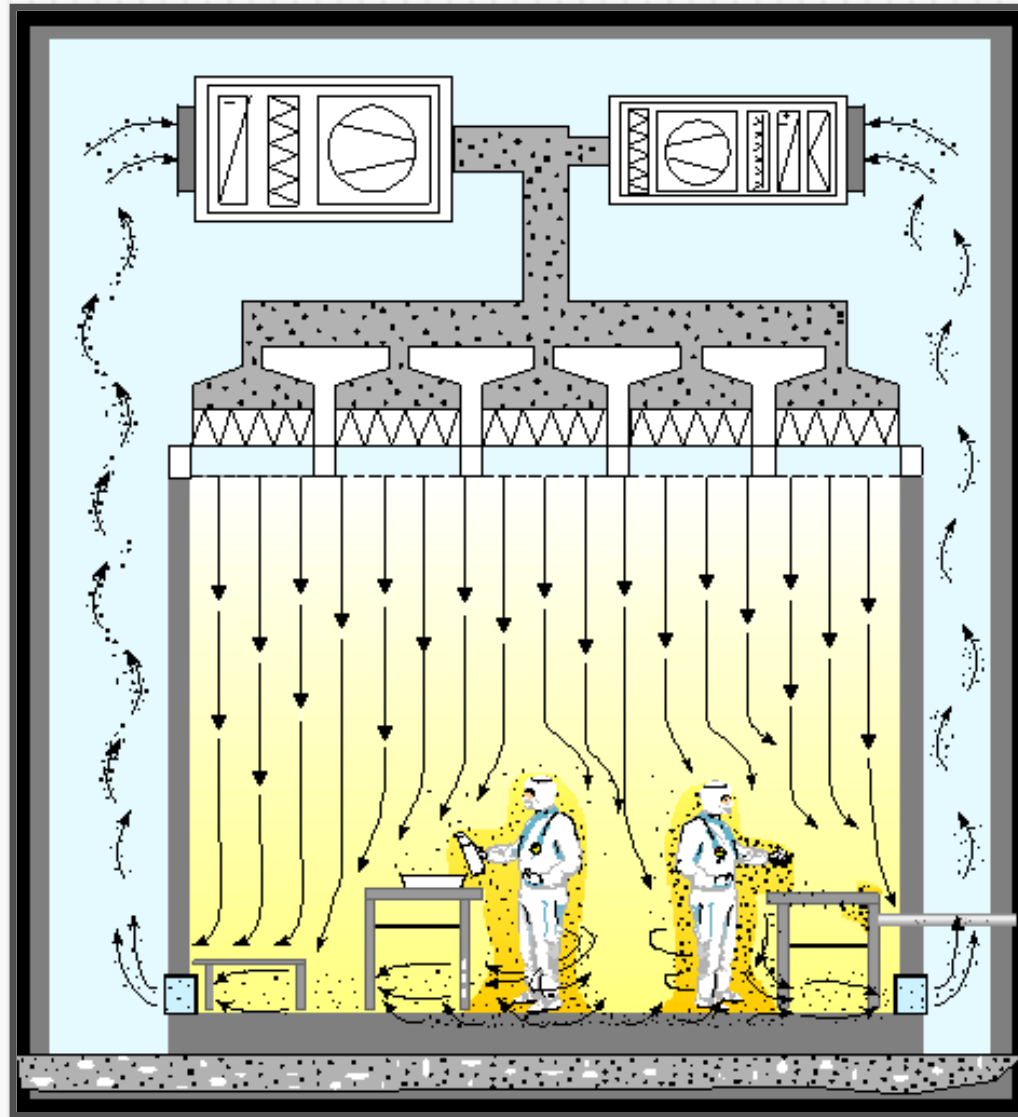
- ❖ A controlled environment that allows essential products to be manufactured
- ❖ Necessary in the nanotechnology, pharmaceutical, medical device, and biotechnology.....
- ❖ Require an unpolluted environment to assure potentially harmful contaminants are not present in construction of products



# HOW A CLEANROOM STAYS CLEAN

- ❖ You need to control entire environment in order to control contamination
  - ❖ Air flow rates and direction, pressurization, temperature, humidity, and specialized filtration need to be tightly controlled.
  - ❖ All sources of particles need to be controlled or eliminated whenever possible.
- ❖ HEPA (High Efficiency Particulate Air) Filters within the ceiling maintain contamination control.
  - ❖ They filter particles as small as 0.3 microns with a 99.97% minimum particle-collective efficiency.

# MOVEMENT OF AIR FLOW THROUGHOUT THE CLEANROOM

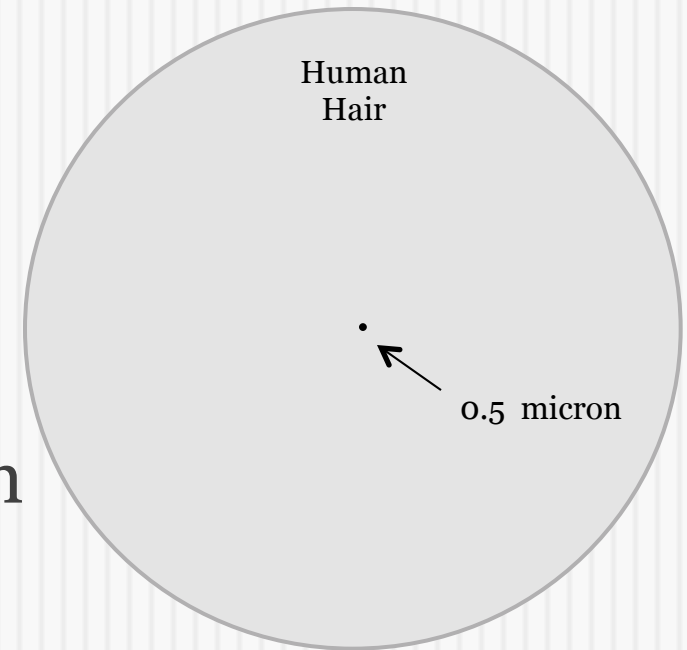




# CLEANLINESS CLASSES

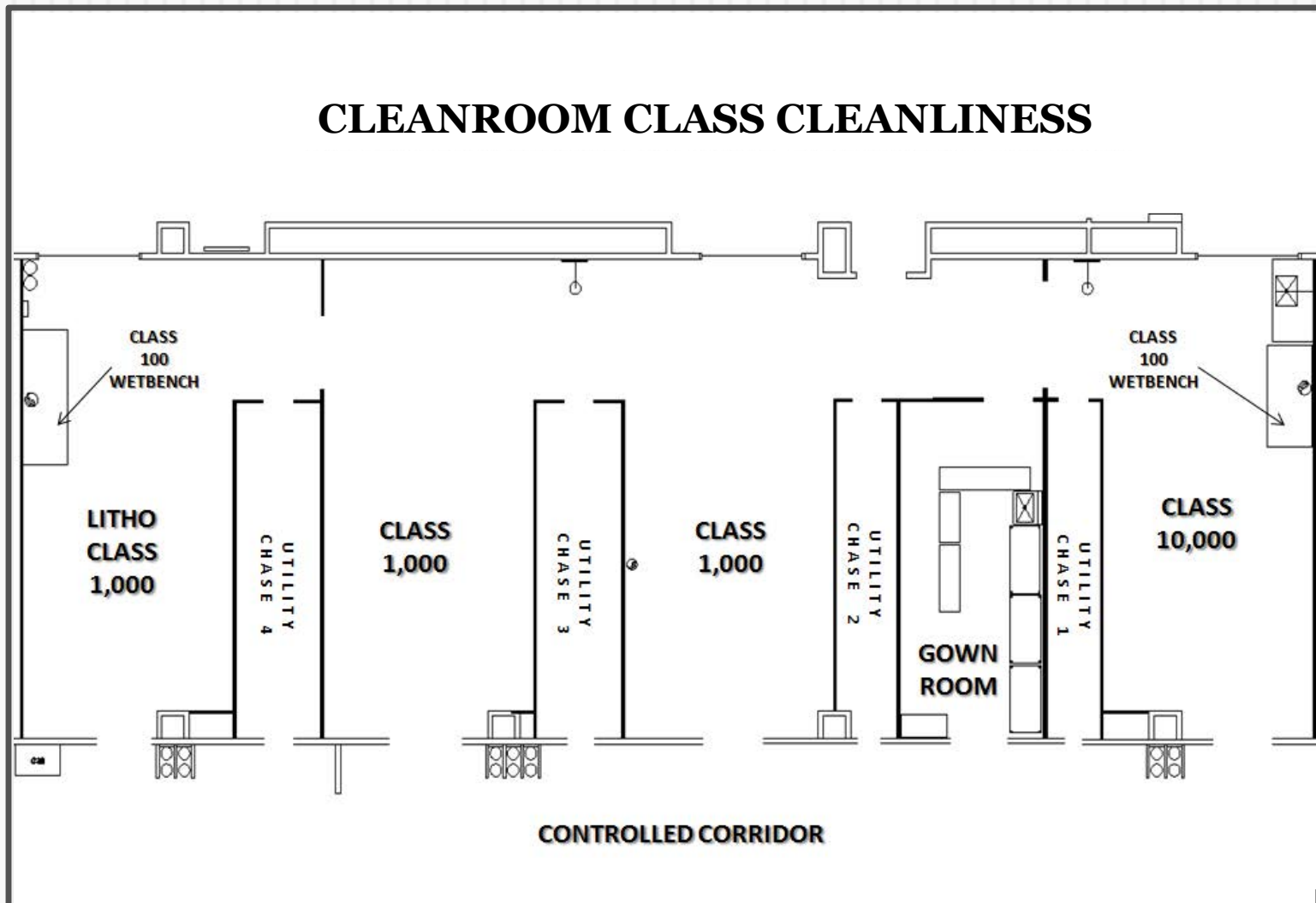
There are three cleanliness classes in our cleanroom:

- Class 10,000 – East portion
- Class 1,000 – West and central portions
- Class 100 – Wet benches located in East and West portions



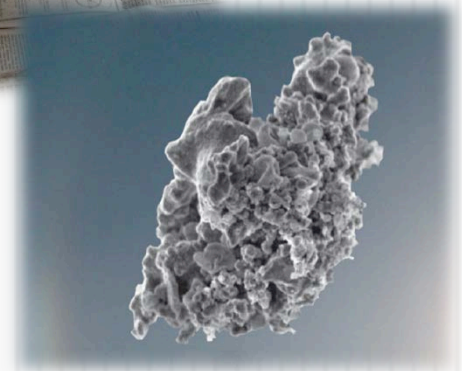
# MAP OF CLEANLINESS CLASSES

## CLEANROOM CLASS CLEANLINESS



# TYPES OF CONTAMINATION

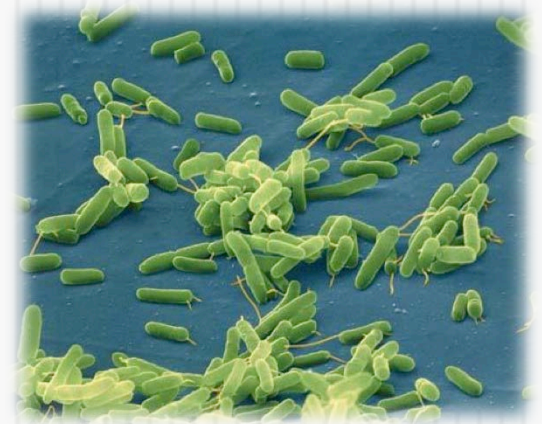
- Particle contamination
  - Dust
  - Corrugated containers/paper
  - Skin and dandruff
  - Footborne dirt from shoes
  - Equipment-generated
- Chemical contamination
  - Ions and non-volatile residues
    - Sodium from hands
    - Ions from rust
    - Off gassing from welding residue
    - Out gassing from hydrocarbon residues



# TYPES OF CONTAMINATION

## ➤ Biological contamination

- Viable organisms
- Bacteria
- Viruses
- Pyrogens
- Spores
- The smallest is 1-2 microns in size



## ➤ Human contamination

- Normal talking (saliva) 2 to 3 feet
- Coughing (saliva/lung tissue) 4 to 6 feet
- Sneezing (200 mph) 10 to 15 feet



# OPERATING PROCEDURES: PRE-ENTRY PROTOCOL

- Access into the Cleanroom
  - The main entrance is located in the controlled corridor on the first floor of the SEB. Users must swipe their Marlok card in order to enter into the gownroom.
  - The cleanroom is open 24/7/365
  - The buddy system is strongly advised.
- Visitors
  - Permission from the Lab Manager, Principal Investigator, or SEB Assistant Director must be given.
  - Must always be escorted by cleanroom qualified user
  - Escort is responsible for ensuring the visitor follows the facility protocol, policies, and procedures

# PRE-ENTRY PROTOCOL

- Bringing Items into the Cleanroom
  - All items brought into the cleanroom must undergo a coarse-cleaning in the controlled corridor then an ultra-cleaning in the cleanroom.
  - Package items that are specific for the Cleanroom must be opened in the cleanroom with cleanroom scissors.
  - Items on a campus cart must undergo a coarse-cleaning and must then be transferred onto a cleanroom cart outside in the controlled corridor. Once in the cleanroom, an ultra-cleaning must be completed on the items on the cleanroom cart.



# PRE-ENTRY PROTOCOL

- Pre-gowning Procedures
  - A daily bath/shower is recommended as well as shampooing regularly
  - Minimal use of cosmetics, hair products, colognes and perfumes
  - Users must not smoke within 45 minutes of use of the cleanroom
  - If special equipment set-up is required, consult the SEB Assistant Director.
  - Before entering gownroom, remove extraneous street clothes and place in provided lockers in service corridor.





# ENTRANCE COURTESIES

- The buddy system is recommended in the cleanroom
- Only authorized users may enter the cleanroom unescorted
- Remove cartons and packaging material *before* taking materials into the cleanroom area
- If you are not sure if it belongs in the cleanroom, ask before you bring it in
- Do not bring in tools with wood, rust, oil, peeling paint, etc.



# ENTRANCE COURTESIES

- 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.
- Keep personally clean – particularly hands, face, and hair
- Do not use cosmetics, colognes, and perfumes in the cleanroom or gowning areas
- NO ONE who is physically ill, especially with respiratory disorders, may enter a cleanroom.
- Keep hair and ears covered with hood or cap

# THE NEED FOR GOWNING

- Maintain the cleanliness of the facility
- Contamination of the facility by exposure to human skin, hair and street clothes must be eliminated to promote a reasonable research environment
- Particles can destroy the ability of researchers to fabricate good devices if not properly contained



# CLEANROOM GARMENTS

Required attire includes:

- ✓ **Shoe covers**
- ✓ **Bouffant**
- ✓ **Face-mask**
- ✓ **Coverall**
- ✓ **Hood**
- ✓ **Shoe booties**
- ✓ **Cleanroom gloves**
- ✓ **Safety eyewear**



# GOWNING PROCEDURES

- 1) In the controlled corridor, remove unnecessary items and place hat, coat, and any other street garments in locker.
- 2) Confirm positive differential pressure  
\*Contact SEB Assistant Director if in alarm.
- 3) Swipe into the gown room using your Marlok card.  
\*Before entering the door, be sure to step on the sticky mat THREE times.
- 4) Put on shoe covers located just inside the entrance of the gowning room. Shoe covers must be worn at all times while in the gown room dirty side.

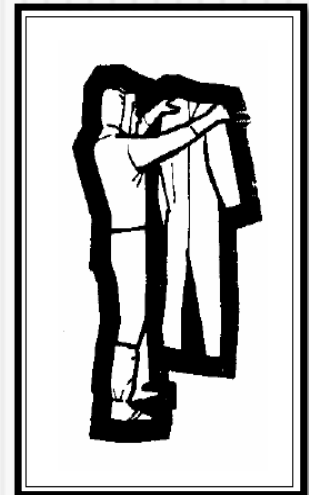


# GOWNING PROCEDURES

- 5) Put on face mask and bouffant. Bouffant is required to protect the hood and contain hair in the hood.
- 6) **For new users:** Assemble your gown then label the coverall, hood, and shoe booties with the date it was assembled and last name

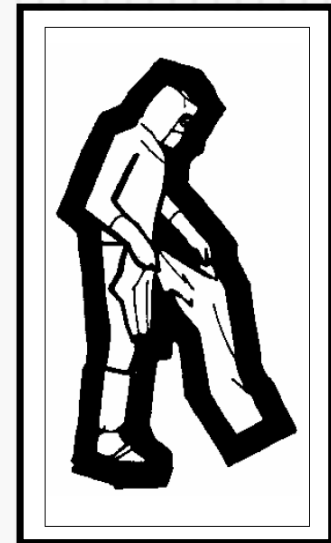
If gown was already assembled, retrieve your gown from the hanger.

\*Only keep gown for two weeks of use (14 working days).



# GOWNING PROCEDURES

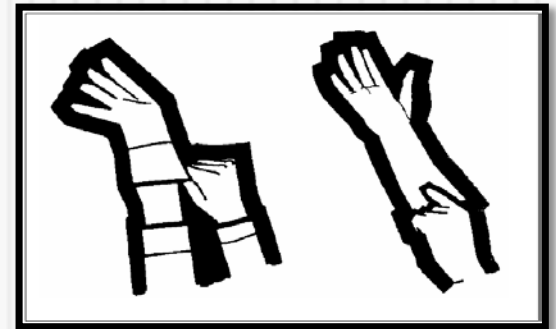
- 7) Carefully put on a hood.
- 8) Inspect the coverall of your gown.
- 9) Put on your cleanroom coverall.
  - \*Make sure it does not touch the ground
- 10) Put on booties as you transition over the bench from the dirty to clean side.
  - \*Booties should only be worn on clean side of the gowning room or in the cleanroom



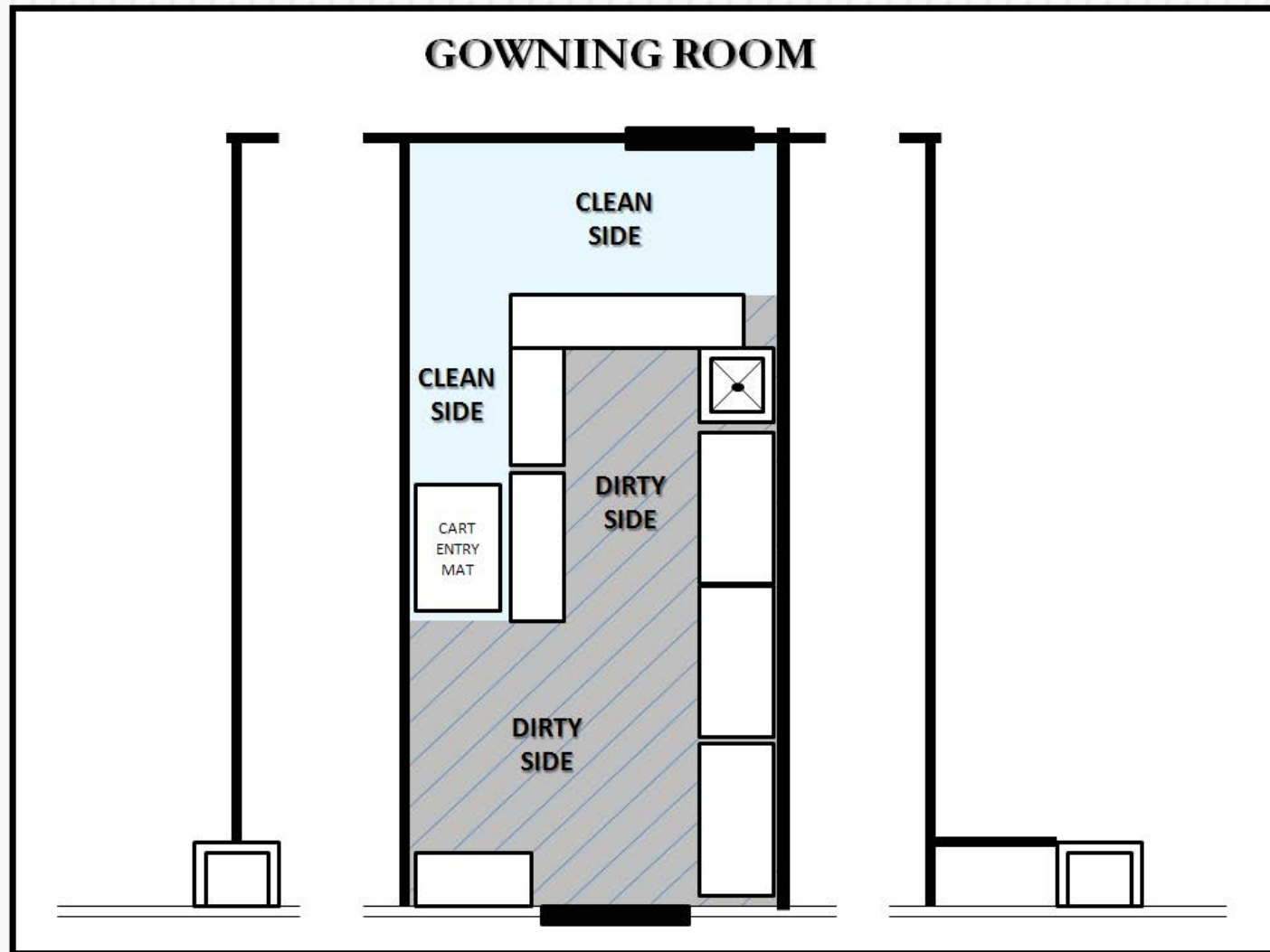


# GOWNING PROCEDURES

- 11) Put on Cleanroom Gloves
- 12) Put on safety eyewear
- 13) Confirm your gown is assembled properly in front of gownroom mirror.
- 13) Step on sticky mat THREE times upon entrance into the cleanroom.



# GOWNING ROOM





# PROPER BEHAVIOR IN CLEANROOM

- Use special care to keep wet benches in ultra-clean conditions
- Never leave hot plates on when unattended
- Minimize the amount of materials stored. Excess storage in the cleanroom is not permitted.
- No paper in any form will be torn or mutilated within the cleanroom
- Be aware of supplies

# PROPER BEHAVIOR IN CLEANROOM

- If you are not sure how a piece of equipment works, ask before you use it
- Use only cleanroom materials present in the cleanroom
  - Cleanroom paper, notebooks, ball-point pens, and tape
- Pencils, erasers, and retractable pens shall not be used within the cleanroom.
- Minimize traffic through the gown room and controlled corridor
- Use knife or scissors to open bags

# PROPER BEHAVIOR IN CLEANROOM

- Obey signs in the cleanroom and on equipment
- When working with acids or solvents, wear chemical resistant nitrile or neoprene gloves
- Do not dump solvents down the drains. Use the solvent waste bins located at the wet benches.
- Be considerate by not touching or messing up someone else's work
- Dilute acid mixtures with large amounts of tap water when disposing

# PROPER BEHAVIOR IN CLEANROOM

- Personal items such as combs, cigarettes, matches, tissues, and similar particle-shedding products **SHALL NOT** be exposed in the cleanroom.
  - Cell phones must always be attached on the outside of the gown, or must be kept in a gown pocket.
- Do not wear jewelry (except plain wedding bands), watches, and pierced ear studs
- Report adverse changes in environmental conditions to the SEB Assistant Director
- ALWAYS clean your bench and equipment with cleanroom wipes when done at your station

# HABITS TO AVOID IN CLEANROOM

- Unfastening cleanroom garments in cleanroom
- Removing items from beneath the cleanroom garments
- Use of hydrocarbon-based aerosol cans is **strictly** prohibited
- Coughing or sneezing persistently
- Bringing wooden tool boxes, wooden-handled tools into cleanroom
- Never comb or brush hair within the cleanroom or gowning area.

# HABITS TO AVOID IN CLEANROOM

- Avoid scratching exposed skin areas, touching face or skin with gloves
- Walking rapidly, or moving unnecessarily, including running, horseplay or any other fast motions, is prohibited
- Chewing gum or tobacco, smoking, eating, or drinking in cleanroom or clean areas
- Wearing torn or soiled cleanroom garments
- Wearing cleanroom garments outside of the cleanroom
- Entering the utility chases in gowning garments when ungowned staff are within

# CLEAN UP PROTOCOL AND EXIT COURTESIES

- If you turn it **ON**, remember to turn it **OFF**
- Do not remove dedicated items from the cleanroom without the Cleanroom Manager's permission
- Any materials you plan on taking out of the lab with you should be bagged
- 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
- If you make a mess, you are responsible for cleaning it up
- Return everything to its original condition, or leave conditions better than you found them

# DE-GOWNING PROCEDURE

1. Enter gown room from the cleanroom
2. Remove safety glasses and place in rack
3. Remove gloves and discard
4. Remove shoe covers as you transition over the bench one leg at a time
5. Remove hood
6. Remove facemask and bouffant and discard
7. Remove coverall
8. Hang up garment (hood, shoe booties, and coverall)
9. Dispose of shoe covers outside the gown room upon exiting



# CLEANROOM UTILITY CHASE ENTRANCE PROCEDURE

## **ENTRY OUTSIDE OF THE CLEANROOM**

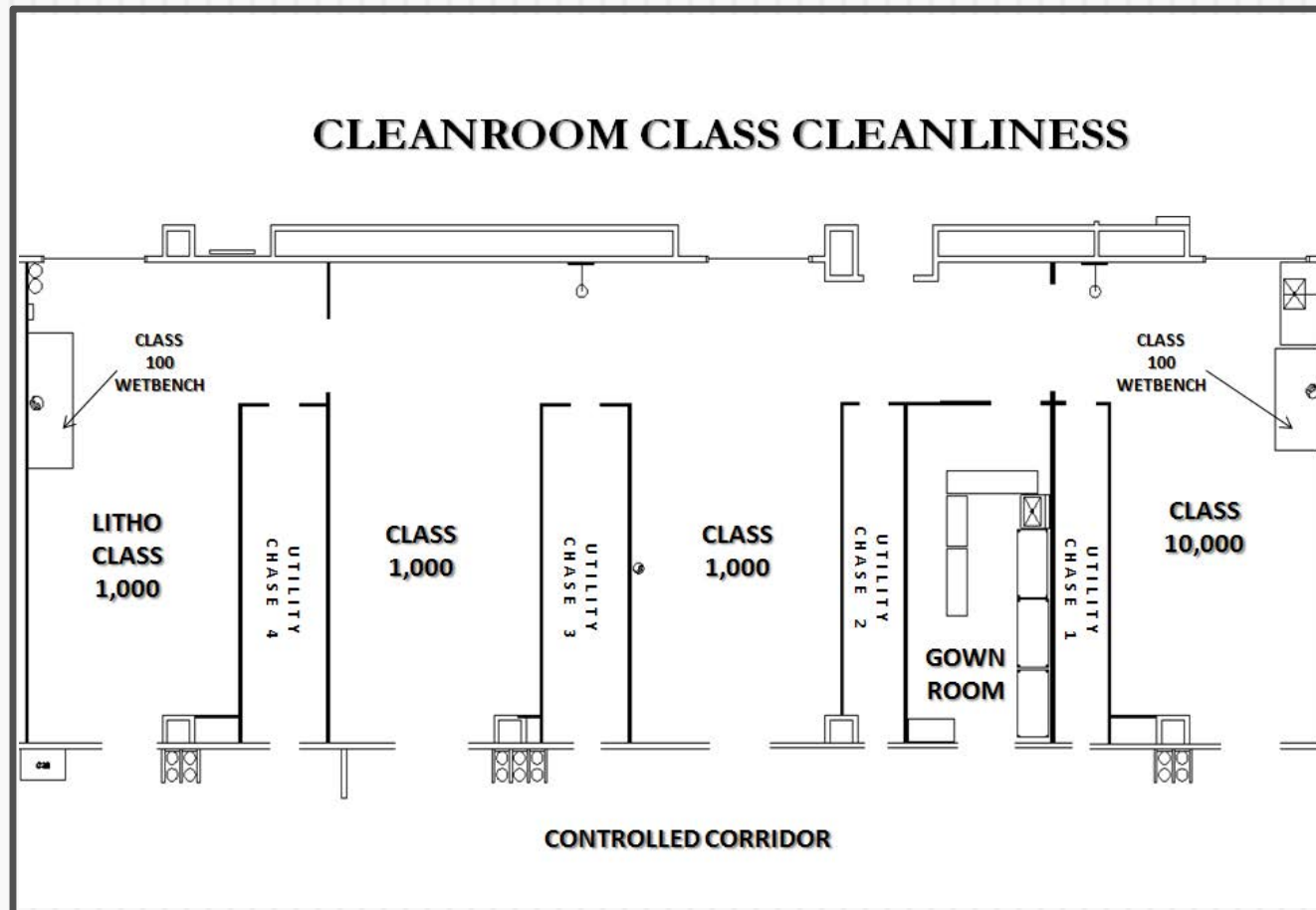
- Entrance into the utility chases from outside of the cleanroom should only be used by SEB Staff or the cleanroom staff.
- Un-gowned SEB Staff, Cleanroom Staff, or Facilities Maintenance (escorted by SEB Staff), must enter only from the controlled corridor OUTSIDE of the cleanroom. They are required to step on the sticky mat and don shoe booties while in the chase. When they are finished with their work, they must exit the same way they came in—through the door that leads into the controlled corridor.

## **ENTRY FROM INSIDE THE CLEANROOM**

- Entry from inside the cleanroom is permitted. Users may enter fully gowned to turn on or adjust equipment. A gowned individual should never be in the utility chase with a un-gowned individual. When returning to the cleanroom, step three times on the sticky mat before reentry.

# CLEANROOM INFRASTRUCTURE

- **DOOR INTERLOCKS, AIR BALANCE, RETURN AIR HANDLERS, HUMIDIFIERS, RETURN FANS, MODULAR WALL SYSTEM, FILTERS. Use caution not to damage.**



# SUPPORT EQUIPMENT

## ➤ WET BENCH

- The Class 10,000 and Lithography wet benches are used to create a cleaner environment to work in. With the HEPA filter and fans within the wet bench, it can become a Class 100 working environment or better. The open front area allows for clean laminar air to flow across the work surface while offering full access for operation. This flow captures particles and fumes and directs fumes through the exhausted slots at the rear of the station's work surface and out through the facility exhausts.

## ➤ SPECIALTY GAS HOOK UPS

- No tanks are allowed in the cleanroom. There are tank stalls for specific gases outside of the cleanroom in the controlled corridor. There are gas manifolds that carry the gas from the tanks into the cleanroom to adjustable valves on the cleanroom walls.

## ➤ CHILLERS

- Non-refrigerated, water-to-water (WW) systems are designed to remove process heat and discharge it to an auxiliary water supply, such as the centrally-chilled building water. These WW systems are ideal where water temperature to the application can be maintained within 3°C (5°F) of the auxiliary water-supply temperature

# EMERGENCY PROTOCOL

## **EMERGENCY SHUT-OFFS AND EVACUATIONS**

- An emergency shut-off may be required at some point in the event of the following situations:
  - A large chemical spill
  - Electrical fire
  - Chemical fire
  - Smoke
- \*\*Contact the SEB Assistant Director, RMS, or the Help Desk if this emergency situation is required.
- \*\*Do not try to clean up a large chemical spill. If the chemical spill is extremely noxious, immediately evacuate the cleanroom without degowning.

# EMERGENCY PROTOCOL

## EMERGENCY EVACUATIONS

- If the building fire alarm sounds within the cleanroom
  - Set down your work in its place
  - Make your way to the nearest cleanroom emergency exit
  - Do not take the time to go into the gownroom to degown
  - Proceed to the outside of the building
  - You may degown outside and dispose; a new gown will need to be assembled

# EMERGENCY EQUIPMENT

## ➤ Safety Showers

- Purpose: To chemically decontaminate a person and their clothing

## ➤ Eye Wash Station

- Purpose: Mitigating a chemical splash in the eyes
- Location:
  - #1 - In the East Class 10,000 cleanroom along the North wall.
  - #2 - In the Central Class 1,000 cleanroom along the North wall
  - #3 - In the Litho Class 1,000 cleanroom along the North wall



# EMERGENCY EQUIPMENT

## ➤ Halotron Fire Extinguishers

- Purpose: Used for small fires by those who are trained to use them
- Location: Wall mounted in each bay



## ➤ Chemical Spill Kit

- Purpose: For small to moderate size chemical spills
- Location: Central Utility Chase in class 1000 area

## ➤ First Aid Kit,

- Purpose: Use for small abrasions, cuts, or burns
- Location: Service hall emergency cabinet



# SAFETY EQUIPMENT

- **Safety goggles:** Located in gown room, must be worn at all times when in the cleanroom
- **Face Shields:** Located at the wet benches.
- **Chemical Resistant Gloves:** Located at the wet benches.
- **Heat Resistant Gloves:** Located at the wet benches.
- **Apron:** Chemically-resistant, aprons are available at the wet benches, and are to be worn when working with hot and/or strong acids, bases, or HF



# SPILL RESPONSE PROCEDURES

## ➤ **Spill Response Box Items**

- Spill Response Kit is located in center utility chase.
- Contains the following items necessary to combat a spill:
  - absorbent spill dam
  - absorbent pillows
  - acid neutralizer
  - caustic neutralizer
  - Hydrofluoric ointment (calcium gluconate 2.5%)
  - pH paper
  - two pair of acid gloves
  - respirators with acid gas cartridges
  - two pair of vapor-resistant goggles
  - trash bags

# POLICIES AND PROCEDURES ENFORCEMENT

- Why?
  - To ensure the safety of the cleanroom users
  - Protect the equipment in the cleanroom
  - Create an environment in which many different research groups can co-exist
- Cleanroom users are expected to:
  - Police themselves
  - Encourage and assist one another in adhering to the policies
  - Flagrant or repeat offenders will be penalized, typically through suspension or expulsion from the cleanroom.
  - The penalties are defined in the Cleanroom Penalties

# CLEANROOM PENALTIES

- The following violations may result in suspension from the cleanroom for **ONE week** or worse:
  - Unlawful use of any cleanroom equipment without being an authorized user for the equipment
  - Allowing a user to enter the cleanroom behind you when he/she has not swiped his/her marlok card
  - Not wearing proper safety equipment at the fume-hood
  - Not following proper gowning and degowning procedures
  - Removing supplies and/or equipment from cleanroom without permission
  - Choosing not to follow any of the procedures and courtesies stated in the Cleanroom Users Protocol

# QUESTIONS?

