

CLEANROOM PROTOCOL GUIDELINES

People play a major role in generating particles inside a Cleanroom. It is important that each of us understand how our personal hygiene and habits affect the Cleanroom's cleanliness. Following are guidelines to help maintain an environment free of human-generated particle contamination.



Photo courtesy of Hewlett-Packard and SBB.

PERSONAL HYGIENE

Maintaining personal hygiene is extremely important for conditioning your behavior and preventing undesirable contamination and the bad habits of your everyday life from entering the cleanroom. When your job entails working in, or sometimes just entering a cleanroom environment, you should get into the practice of wearing non-linting street clothes of cotton or polyester blend fabrics. Avoid nylon and other synthetic fabrics which have a natural tendency to create static and attract particles. Fuzzy sweaters, scarves or socks are never a good idea.

When it comes to cosmetics deodorant is definitely encouraged. The dry, unscented, non-powder brands, such as roll-on, gel or stick types are preferred. Lip moisteners are good, but certain lipsticks that easily transfer color or other residue, rouge, powder, eye shadow, eyebrow pencil, mascara, hairspray, perfume or cologne are not recommended as these all particulate or outgas.

Daily bathing and shampooing are encouraged as this helps control flaky skin and dandruff. Fingernails should be trimmed relatively short, and if fingernail polish must be used, use only non-flaking, non-metallic and non-glitter types. Long nails are discouraged since they can puncture gloves or finger cots.

PERSONAL HYGIENE (Cont'd)

Wash your hands before entering the cleanroom with a specially formulated cleanroom cleaner and moisturizer as this removes dead cells and prevents skin from flaking. Use only the hand soaps and moisturizers provided by your employer for this purpose. Certain over-the-counter store bought lotions contain sodium and oils that are not cleanroom compatible. It is not recommended that you scratch or rub your skin when inside the cleanroom as this can cause exfoliation and product contamination.

Your hair should be combed frequently before entering a cleanroom since combing removes dandruff and loose hair. Wear a bouffant cap; bangs must be completely covered under the bouffant -- no exceptions. Never remove your bouffant inside the cleanroom or gowning room and never, ever comb or brush your hair when inside the gowning room or cleanroom.

Chewing gum and sucking mints should never be allowed. But do drink water before entering the cleanroom. This will help keep your body hydrated. A water fountain can be installed just outside the cleanroom. Never bring food or drinks inside the cleanroom. Smoking should be avoided up to 15 minutes before entering the cleanroom; this will give your lungs a chance to clear.

GARMENTS & PERSONAL ITEMS GENERAL RECOMMENDATIONS



Typical Cleanroom Garments
Photo courtesy of Cintas Corporation.

When it comes to Jewelry, wedding and engagement rings are acceptable, though rings with prongs or sharp edges should be avoided since they can puncture gloves or garments. If they must be worn, then they can be tape wrapped before donning gloves and other garments. Dangling earrings, necklaces, broaches and other protruding or hanging jewelry are not recommended, even if normally worn under street clothes. There could arise instances where these interfere with cleanroom or laboratory activities.

GARMENTS & PERSONAL ITEMS (Cont'd)

Keep personal items such as cigarettes, purses, tissues & paper products inside your desk or locker – do not take them into the cleanroom. Cleanroom garments with pockets should always be empty, unless authorized by your supervisor. Eyeglasses or goggles are strongly recommended since our eyes spew out mucus every time we blink. Wipe glasses and goggles clean of any visible particle contamination before entering cleanroom.

Dry skin flakes, exhalent and saliva can cause product contamination. Wearing a face mask varies with each individual company, but operators with side burns, mustache or beard should wear beard covers. Disposable booties are recommended and should be changed once or twice daily. Most gowning rooms have a clean and dirty side and protocols should always be followed. Never walk outside the gowning room with booties on and return wearing the same booties.

Bouffant caps are always recommended. Hair, including bangs, must be covered completely, there are no exceptions. Remove bouffant cap once outside the cleanroom or gowning room, never within the cleanroom. And never use the same bouffant cap if worn outside the cleanroom / gowning room.

If lauderable frocks or coveralls (bunny suits) are utilized, then it's recommended that they be changed once or twice a week or whenever garment becomes soiled. This procedure varies with each company's policies.

Procedure for Putting on Coveralls (bunny suits): Hold cuff of sleeves in palm of hands. Roll up coverall pant legs and put one leg inside coverall at a time. Stand up straight and remain holding sleeves, let go of one sleeve and put one arm inside sleeve, then let go of the other sleeve and put the second arm in sleeve. Zip up garment and you're ready to go to work. This procedure requires practice and balance. You may need to sit down to put on your garment.

Garments must not touch the floor. Touching the floor contaminates the garment. If garment touches the floor, get a clean fresh garment.

If gloves are required, then use cleanroom powder-free latex or vinyl gloves. Vinyl gloves should be worn if redness appears on hands after wearing latex gloves since some operators are allergic to the proteins in latex. Change gloves whenever they discolor, or when small holes appear – but not in the cleanroom. Gloves should always be changed in the gowning room. Never pull briskly and snap off the gloves, gloves should always be removed slowly.

HOUSEKEEPING GENERAL RECOMMENDATIONS



A properly attired and equipped cleanroom cleaning crew.

Photo courtesy of Advanced Cleanroom Microclean.

TACKY MATS are recommended for cleaning the soles of shoes before entering a clean environment. The size of the mat varies with door entry openings. They are typically placed outside gowning room doors, inside the gowning room and at main cleanroom entry doors. They are not required at exits. Step on the mat at least twice with each foot. Changing layers frequently captures loose dirt and keeps the dirt out of the cleanroom. Change layers at least two or three times daily (traffic dependent.)

Procedure for removal of film layers: Look for color tab on end of mat. Lift up tab and slowly peel layer away from mat. Continue peeling film upward separating it from the mat until all 4 corners are separated. Bring all four corners together in the center of the mat, forming a tent like appearance. Slowly separate the film from the center of the mat. Fold film inward until it is small enough to discard. This procedure ensures that the dust particles will be captured inside the film. Soiled sheets should be discarded outside the gowning room area.

It is not recommended that you pull the tab briskly and rip the film from the mat. This method allows particles to become airborne and enter the cleanroom. Go slow and deliberate.

Specialized **HEPA-filtered vacuums** are recommended and best suited for periodic cleaning. They are available in wet / dry or dry styles and are great for cleaning up spills. Hazardous spills must be properly attended to by trained safety personnel. Walls and ceilings can be dry vacuumed.

Cleanroom wipers, wet or dry, that are certified for your cleanroom classification are recommended and should be properly disposed of whenever soiled, torn or abraded. Floors should be mopped or vacuumed once or twice a day. (This may vary from company to company.) Use only HEPA vacuum cleaner or low-particulating cleanroom mops.

HOUSEKEEPING (Cont'd)

Aqueous solutions, without sodium, potassium, ammonia, iron, copper or nickel are recommended for periodic wet cleanups. Detergents and disinfectants may require additional rinsing with cleanroom-compatible water, such as distilled or de-ionized water. If lubricating oils are to be used, consult your cleanroom manager for acceptable lubricants. Typically low-out gassing oils are recommended -- wipe all residual oils from surfaces after lubrication to prevent particle accumulation.

Doors, frames and thresholds should be cleaned on a regular basis. Wipe the top of the door first, then the sides and edges. A pre-saturated wiper is well suited for this. Tables, carts, etc. should also be cleaned regularly. Wipe furnishings slowly using long overlapping strokes. When wiping tables or work stations start at the back and move forward. Never wipe with fast or brisk strokes as this causes air turbulence within the cleanroom. And don't forget to wipe underneath carts and tables.

Set up an in-house cleaning routine, or use trained outside professionals for periodic cleaning. Frequency may vary from once a day to once a week. Start at the dirty end of the cleanroom wiping down the ceiling first and work your way down the walls toward the floor. Work in small sections at a time and change solutions / water frequently. Additional rinsing may be required, particularly when using detergents. It is not recommended that you use brisk strokes or side-to-side strokes. Try to use a slow and deliberate, vertical and overlapping method.

Flexible vinyl walls or curtains can be wiped down with pre-saturated wipes. Start at the top of the curtain and move towards the floor. Follow up with a dry wiper to remove any moisture remaining on the vinyl. Always use a Cleanroom wiper with sealed edges. Outside walls of the cleanroom can be wiped with Simple Green and a non-abrasive, non-linting cloth.

Lights should also be cleaned. Make sure wiper and solutions will not scratch or etch the lens. Before cleaning, test wiper on a small section of lens that is typically not visible. A pre-saturated cleanroom wiper may be best suited for the job. Clean the inside of the light starting at one end and move to the other side, using long overlapping strokes. Then clean the outside in the same manner.

When cleaning glass, acrylic or polycarbonate windows the selection of wiper and cleaning agent is vital. Plexiglas (polycarbonate or acrylic) windows can scratch or craze. Check with window manufacturer for compatible chemicals. Squeegees make cleaning easy. Handles should be stainless steel or plastic coated. Use blades that are low in particulate shedding. Start at top of window and move towards floor in slow, overlapping strokes. Check blades frequently since old blades may have exposed metal that can scratch the windows.

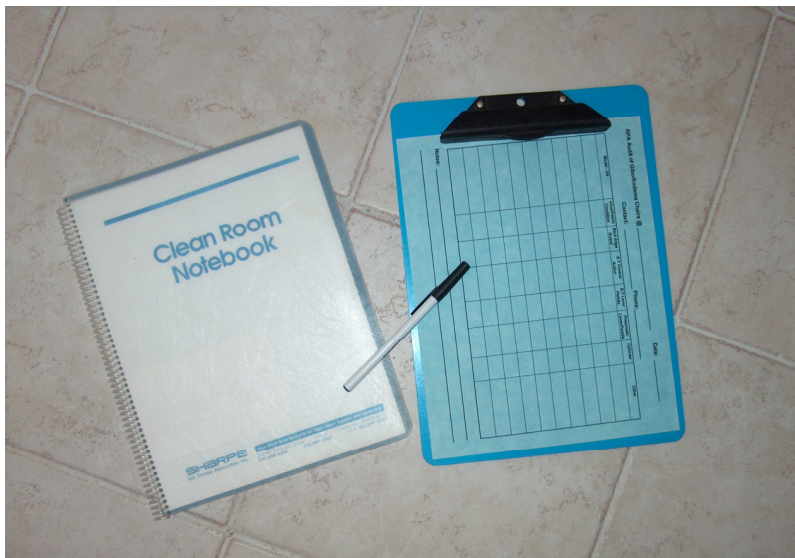
Ladders and step stools are often a vital tool inside the cleanroom and cleanroom-compatible units are available in the market. Never bring a wooden or a rusty ladder or stool into an active cleanroom, and never stand on a table, chair or cart.

When it comes to cleaning buckets and wringers, units with casters and of stainless steel or plastic construction are preferred. Keep buckets, mops etc. inside a designated area within the cleanroom or gowning room. It's best to designate a specific cleaning cabinet within the area. It is not recommended that you remove cleaning tools from the cleanroom area after each cleaning. This may cause cross contamination. Note that some utensils may contain galvanized parts which are subject to corrosion. Remove them from cleanroom use immediately if corrosion appears.

HOUSEKEEPING (Cont'd)

If hand tools or other materials are required, then keep a cleanroom-dedicated set of tools inside the area to perform routine maintenance. Wipe down all tools before entering gowning room with a cleanroom-compatible pre-saturated wiper. Wipe again inside gowning room, prior to entering the main cleanroom. All cleaning tools must be cleaned, rinsed and dried before placing into storage cabinet. This prevents mold and mildew.

PAPER AND CONTAINERS GENERAL RECOMMENDATIONS



Cleanroom notebook, clipboard, paper & stick pen.

Photo courtesy of RPA

Use only cleanroom-compatible notebooks, paper, binders and clipboards within the cleanroom. Consult manufacturer(s) for cleanroom rating. **Caution**, before putting cleanroom paper into a copy machine or printer, check with the manufacturer for office equipment and thermal compatibility. Some paper types may have a tendency to melt, leaving a residue on the rollers of the machines, creating contamination and possibly destroying your machines.

One-piece ballpoint “stick” pens are best for cleanroom use. Click-type pens typically generate metal and plastic particles when they retract. Never use a graphite (lead) pencil in a clean environment

Waste receptacles (trash cans) should be stainless steel or one-piece molded plastic and flexible plastic liners should be utilized. Remove trash liners by folding all four corners into the center of the waste receptacle. Close liner, taking care not to let air escape into the cleanroom. Take receptacle into gowning room to wipe down and wipe receptacle inside and out daily.

Standard & ESD plastic totes, boxes and containers are commercially available in all sizes. Never take cardboard or wooden containers into the gowning room or cleanroom. These fibrous containers are large particle generators.

If adhesive tape is to be used, use only conductive or standard cleanroom-compatible tape.

SAFETY PROCEDURES GUIDELINES



Graphic courtesy of Rueger Signs and Graphix.

Know where all fire exits and fire extinguishers are located in and around the cleanroom. Be aware of any hazardous chemicals or substances in your vicinity and know how to deal with any potential accident or spill. Know who is in charge if an emergency occurs and report all accidents to them and to your supervisor, no matter how minor.

Whenever a cleanroom is shut down, whether for major maintenance, an unexpected power outage, or just for routine reasons, be sure to perform a routine cleaning after the shut down and before the next use. When a cleanroom is re-started after a prolonged shut down it should be re-certified according to Federal Standard 209E or ISO Cleanliness Class requirements.

The above protocol guidelines are typically intended for users installing a cleanroom for the first time and wish to train operators on proper gowning and cleaning procedures. Refer to RPA's "CLEANROOM DO's & DON'Ts" for an even quicker reference guide. Also be advised that cleanroom protocols vary depending on cleanroom classification, company policy and products manufactured. It's also recommended that new cleanroom owners refer to the "IES Cleanroom Housekeeping – Operating and Monitoring Procedures" before commissioning and cleaning the new cleanroom.