Specific Lab Safety Procedure

Johnson's Group

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1. Purpose

The purpose of this procedure is to support work practices for protecting laboratory personnel from potential health hazards in the laboratory.

1. Laboratory Safety Guidelines

1.1 GENERAL LABORATORY SAFETY

- Do not eat, drink, or apply cosmetics in the lab.
- Store food and drink in food designated refrigerators only. Don't mix chemicals and food.
- Tie back medium length and long hair and remove or secure dangling pieces of clothing (e.g. ties, draw-strings, headphones, etc.) when working near flames or entangling equipment.
- All accidents, no matter how minor, should be reported to the faculty/staff member supervising the laboratory.
- Know the location of all safety equipment (e.g. eyewash, fire extinguisher, fire blanket, safety showers, spill kit) if available.
- Keep aisles clear.
- Maintain unobstructed access to all exits, fire extinguishers, electrical panels, emergency showers, and eyewashes.
- Do not use corridors for storage or work areas.
- Do not store heavy items above 6 feet high.
- Consult with your Principal Investigator if planning to work alone or running an unattended operation.
- Avoid working alone in the lab when performing high-risk operations.
- Keep area clean and uncluttered; clean up area upon completion of task or at end of the day.

1.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Review SOP, MSDS and other hazard information to determine appropriate PPE to wear based on chemical hazards encountered.
- Remove gloves when leaving the laboratory, so as not to contaminate doorknobs, etc.

1.3 ELECTRICAL SAFETY

- Don't use permanent extension cords.
- Don't daisy chain power strips.

1.4 CHEMICAL SAFETY

- Know the hazards of the chemicals you're working with. Consult the material safety data sheet (MSDS) or other appropriate references prior to using a chemical with which you're unfamiliar.
- Make sure all chemicals are clearly and currently labeled with the substance name.
- Use volatile and flammable compounds only in a fume hood. Procedures that produce aerosols should be performed in a hood to prevent inhalation of hazardous material. Be sure the fan is on at all times when using a fume hood. Fume hoods should not be used for storage.

- Material Safety Data Sheets (MSDS) shall be provided for all hazardous chemicals before use.
- Keep proper records of time sensitive chemicals (oxidizers, THF, and organic peroxides), and dispose of all these chemicals before their expiration date.
- Perform proper housecleaning of your lab area once a year to discard of unused chemicals and materials. General chemicals that have been around for three years or more should be discarded.
- Provide a check in procedure for incoming researchers and visiting researchers. Review safety and operational procedures with them.
- If a researcher will be leaving Caltech, please go through a check out procedure with your researcher (visiting and otherwise) that all chemicals and related materials (desiccants, silica filtration beads, etc.) are also properly disposed of, prior to them leaving Caltech. This helps to avoid any unknowns in your lab area, which are difficult to manage by the Institute.
- Clean up of large spills should not be attempted. Call Environmental Health and Safety Office at 6727 for clean up.
- Ensure all waste containers are properly labeled.

1.5 FUME HOODS

- Ensure the fume hood is labeled with a certification date of less than one-year prior.
- Maintain hood sash at or below the maximum height indicated by an arrow on the side of the fume hood. Close the hood sash when not working in the hood.
- Equipment used in hoods should be placed securely on blocks to allow air to flow under and around the equipment.
- Keep chemical sources and equipment at least six inches away from the face or rear of the hood.
- Don't store equipment and chemicals in the hood to avoid dead air spaces and to prevent blocking back baffles.
- Visually inspect baffles (openings at the top and rear of the hood) to be sure slots are open and unobstructed.
- All electrical devices should be connected outside the hood to avoid sparks that may ignite a flammable or explosive chemical.
- Do not use a fume hood for any function which it is not intended. Certain chemicals or reactions require special constructed hoods. Examples are perchloric acid or high pressure reactions.
- If you are not sure if there is sufficient airflow in your fumehood due to extra equipment, please contact the EHS Office and we will perform a survey for you.

1.6 FLAMMABLE AND COMBUSTIBLE LIQUIDS

- Use fire-hazard chemicals in vented hoods and away from sources of ignition. Fire-hazard chemicals are chemicals with a flash point below 200° F (93.3° C).
- Store flammable liquids in excess of 10 gallons in approved flammable liquid storage cabinets.
- Follow proper storage procedures for flammable and combustible liquids. This includes not storing corrosives and flammables in the same cabinet.

1.7 CORROSIVE AND CONTACT-HAZARD MATERIALS

Corrosive, allergenic, and sensitizer information is given in MSDS and on chemical container labels.

Handling processes should be designed to minimize the potential for splash, splatter, or other likely scenarios for accidental contact. Handle corrosive chemicals and contact-hazard chemicals with all proper safety precautions according to the way they will be used. This may include wearing both safety goggles and face shield, gloves tested for absence of pinholes and known to be resistant to permeation or penetration, and a laboratory apron or laboratory coat. Additional protective clothing (i.e., apron, oversleeves) is appropriate where chemical contact with body and/or skin is foreseeable.

- Do not pour water into acid. Slowly add the acid to the water and stir.
- Open bottles or carboys slowly and carefully and wear protective equipment to guard hands, face, and body from splashes, vapors, gases and fumes.
- Use a mechanical aid or a pipette bulb for pipetting.
- Wipe drips from containers and bench tops. Be especially careful to wipe up visible residues of sodium hydroxide and potassium hydroxide from all surfaces. Skin contact with dry residue will result in burns.
- Strong acids/bases are to be handled in a fume hood.
- Corrosives should never be stored above eye level.

1.8 GLASS BLOWING

When doing any glass blowing work, students are exposed to open flame, hot glassware, and sharp edges of the glassware. The following is a list of important rules:

- Appropriate eye protection is required at all times.
- Heat only clean, solvent free glassware.
    - Never heat glass with volatile or toxic materials inside.
    - After rinsing glassware with solvents, air dry the apparatus to make certain that no solvent remains. (Explosion could result.)
    - Metal vapors must never be present in glass to be heated. The most common metal encountered in glassware is mercury. Remove all traces of mercury before heating and blowing on this glassware.
    - Silicone stopcock grease is another source of contamination in heated glassware. A fine white powder (silica) is produced when heated to high temperatures. This silica will fire into the glass and, in turn, weaken it.
- Protective clothing
    - Open toe shoes are not to be worn during this operation.
    - Long hair should be tied back.
    - Avoid wearing synthetic clothing that will burn and melt when exposed to flames or hot glass.
    - Roll up long sleeves so they won't catch on fire.
    - Heat insulated gloves are available to handle hot glassware.
- Know location of each of the following, if available:
    - Fire blanket
    - Fire extinguisher
    - Safety shower
    - Eye wash

- Clean up broken pieces of glass and put them in the designated bin as soon as done with glass blowing. Useful scraps should be put in the box of scraps, and finished pieces once cooled should be moved away from the immediate work space.
- **Always ensure both the gas and oxygen tanks are closed when you are finished.**
- Do not over tighten the needle valves on the torch. They are fragile and can break.

1.9 FURNACE

- Always assume a furnace is hot.
- Leave a note if any material near a furnace, or the furnace itself, is hot.
- Wear close-toed shoes, long pants, and non-synthetic fabrics when using furnaces.
- Take care when quenching materials directly out of a furnace. Always ensure there is adequate cooling and wear eye protection in case of shattering

1.10 COMPRESSED GAS CYLINDERS

- **For all lab personnel:**
  - Should be familiar with the gas container content and the potential hazards. They should have access to the appropriate Material Safety Data Sheet.
  - Secure cylinders at the top and bottom. Keep the cylinder capped when not in use.
  - All gas cylinders, including lecture and empty bottles, should be in an upright manner and chained.
- **For lab personnel responsible for changing out compressed gas cylinders:**
  - Wear safety glasses when handling compressed gases.
  - Do not lubricate, modify, force, or tamper with cylinder valves.
  - Always make sure that the regulator appears sound before attaching it to a cylinder.
  - Make sure that the correct regulator and CGA connector is being used. Table 1: CGA Connection Chart. If the connections do not fit together readily, the wrong regulator or a defective regulator is probably being used.
  - Use only the correct fittings and connections to ensure compatibility. Make sure that the threads on the cylinder and the connection mate, and are of a type intended for gas service.
  - Attach the regulator securely with the secondary valve closed and preferably with the regulator flow backed off (counterclockwise) before opening the cylinder valve wide.
  - When cylinders are no longer in use, shut the valves, relieve the pressure in the gas regulators, remove the regulators and cap the cylinders.
  - Before returning empty gas containers, a check should be carried out to ensure that the container valve is closed (and not leaking) and that the valve outlet plug (or cap nut) has been securely refitted.
  - Leave a small amount of contents in the cylinder to avoid contamination.
  - Segregate gas cylinder storage from chemical storage.
  - Keep incompatible classes of gases stored separately. Keep flammables from reactives which include oxidizers and corrosives. For example, keep cylinders containing oxygen or oxidizing gases away from flammable solvents, combustible materials, unprotected electrical connections, gas flames or other sources of ignition.
  - Always label cylinders so you know their contents; do not depend on the manufacturers color code. Gas cabinets should have a clear label on the outside.

- Note the name and phone number of the supplier of the cylinder. Cylinders are generally "loaned" when they are distributed, and the empty cylinders are to be returned to the supplier once you are finished with the gas.
- If a cylinder of material has been here for more than three years, please contact the EHS Office and mark it for return to the supplier.

1.11 BERYLLIUM

- "Repeated or prolonged contact may cause skin sensitization. Lungs may be affected by repeated or prolonged exposure to dust particles , resulting in chronic beryllium disease (cough, weight loss, weakness). **This substance is carcinogenic to humans.**" - CDC Safety Cards
- Exposure to beryllium oxide is extremely dangerous. Take extreme caution when weighing out elemental beryllium
- After melting any beryllium-containing alloy perform extra argon purges, and wipe the interior of the chamber down with a kimwipe wetted with ethanol.
- Do not machine any beryllium containing alloys.
- When cutting or polishing, always be sure the sample is kept wet to collect any dust created.

1.12 ARC MELTER

- **Never leave arc melter unattended while the power supply is on.**
- **Never look at the arc without safety glass in place.**
- When arc is lit, always keep your full attention on the arc.
- Never melt Be-containing alloys in the non-Be arc melter.
- Ensure cooling water is on during use.
- Be sure to use the high vacuum gauge if using the turbopump.

1.13 INSTRON

- Be aware of all moving and operating components that are potentially hazardous.
- Read all relevant manuals and observe all Warnings and Cautions.
- Press the Emergency Stop button whenever you consider that an unsafe condition exists.
- When possible, use the height-based stop triggers to prevent the machine from reaching unsafe conditions.
- Set software limits to stop the program at designated forces and displacements to ensure safety.
- Make sure that test specimens are installed correctly in grips or fixtures in order to eliminate stresses that can cause breakage of grip jaws or fixture components.
- Wear protective clothing when handling equipment at extremes of temperature.
- When using the furnace with the Instron, be sure to wear safety goggles.
- Take care when installing or removing a specimen, assembly, structure, or load string component.

- Do not place a testing system off-line from computer control without first ensuring that no actuator or crosshead movement will occur upon transfer to manual control.
- Keep clear of the operating envelope of a robotic device unless the device is de-activated.
- Disconnect the electrical power supply before removing the covers to electrical equipment.
- Disconnect power supplies before removing the covers to rotating machinery.
- Shut down the hydraulic power supply and discharge hydraulic pressure before disconnection of any hydraulic fluid coupling.
- Ensure safety shields are in place anytime the machine is in operation.

1.14 RF Power Supplies

- NEVER TOUCH RF LEADS while system is powered.
- Do not place any metal substances in between RF leads.
- Always be sure cooling water is turned on prior to turning on a power supply.
- If any sparks or shorting occurs, immediately turn off the power supply.

1.15 RDF

- **Never bypass safety mechanisms**.
- Never leave the machine on while unattended.
- Take extreme caution when working underneath the piston.
- Never pull electrical leads outside of the safety enclosure.

1.16 Lathe and mill

1.16.1 Shop safety

- Eye protection is essential. Always wear safety glasses when using machinery.
- Always wear closed-toe shoes in the shop.
- Remove or secure anything that might get caught in moving machinery. Rings, necklaces, long hair, loose clothes, and headphones.
- Keep your hands away from sharp tools, and your fingers clear of running machines. Use special tools such as, clamps, vises, pliers, etc.
- A hammer should not be used to strike a hardened tool or any machine part.
- If a tool is damaged, dispose of it properly or leave it with a note. Don't put it back.
- Chuck keys are to be removed before starting lathes, drills, mills.
- Don't operate the machines without the appropriate guards in place.
- Remove chips with a brush or compressed air, never by hand or by blowing. Be careful of sharp edges.
- Clean machine and surrounding when finished or at the end of the day.

1.16.1.1 Lathe

- Wrenches, tools, and other equipment should be kept off the machine spindle/table as well as off all moving units of the machine.

- Rotate your workpiece by hand to make sure it clears the tool rest and bed before turning the lathe "on." Be certain that the workpiece turns freely and is firmly mounted.
- Step out of the area directly behind and in front of the workpiece—the areas most likely for a piece to travel as it comes off the lathe when turning on the lathe, keeping your hand on the switch in case you need to turn the machine off.
- ALWAYS CHECK THE SPEED OF THE LATHE BEFORE TURNING IT ON. Use slower speeds for larger diameters or rough pieces, and higher speeds for smaller diameters and pieces that are balanced.

1.16.1.2 Mill

- Always remember to remove wrench after tightening bolt for collets and arbors.
- Use soft hammer to loosen collets, not a wrench or steel hammer.
- Make sure gears are engaged in head before turning power on.
- Always shut machine off & use brake before reversing spindle.
- Shut machine off & move cutter away from workpiece, do not check workpiece while spindle is moving.
- Don't use too heavy a feed or too heavy a cut when using cutters in a milling machine.

1.16.1.3 Rolling Mill

- Always wear safety glasses when using the rolling mill.
- Decrease the rolling thickness slowly. Making too large of steps can damage the rollers.
- Insert any small samples with a pushing stick. Do not use wood or metal as they can splinter or damage the roller. A piece of paper folded on itself a bunch of times or a very thin piece of plastic is a good choice.
- Do not stand directly behind or in front of the rollers as samples can shoot out either way forcefully.
- Rolled materials can get very hot after severe deformation. Take caution when dealing with them.

1.16.1.4 Spot Welder

- Never place fingers between leads.
- Never leave spot welder on when it's not attended.
- Discharge the capacitor after turning the spot welder off.

1.17 OLD, DAMAGED, OR NO LONGER USEFUL EQUIPMENT

- Review the equipment asset list for your lab at least once a year to see if you have old, damaged, or outdated equipment that require disposal.
- For proper disposal, notify the Safety Office if you believe that the equipment has been used for radiological, biological, or chemical work. The types of equipment should be decontaminated and certified prior to disposal, and the Safety Office is able to assist you with this process.
- Contact your Building Administrator if you have a large amount of e-waste for disposal, as they work with you to get this matter taken care of, or you may take it over to the Recycling Center on the first Wednesday of each month between 9:00am and 12:00pm for proper disposal.
- Try not to leave old equipment in the hallways, as these are potential fire hazards.

1.18 SHARPS WASTE MANAGEMENT

- Must be appropriate for the size of the items being placed in the sharps container
- All sharps are to be disposed in appropriate sharps containers
- Must be sealable (taped closed or tightly lidded)
- Should be no more than 2/3rds full
- Are available at the Biology Division and VWR stockrooms
- Close the sharps container according to the manufacturer's instructions when it is 2/3r d full and call the Environment, Health and Safety Office to request a pickup at x6727
- Never place sharps in regular or solid biohazardous waste bags as they can puncture the bag and cause injury

1.19 HAZARDOUS WASTE MANAGEMENT

- Hazardous waste containers must be completely labeled and dated when the first drop of hazardous waste goes inUse only authorized Institute Hazardous Waste Identification Tags for container labeling. See the Environment, Health, & Safety website for more information: www.safety.caltech.edu
- Waste containers must be kept closed except when adding hazardous waste
- Do not fill a waste container completely to the top. Provide room for air space
- Do not place incompatible chemicals in a waste container
- EHS must receive all hazardous waste containers within 9 months from the date of initial accumulation
- Dispose of your waste at the completion of a project. Do not abandon the waste, so that someone else must deal with it
- Call EH&S for waste pick-up

1.20 EMERGENCY RESPONSE PROCEDURES

- Emergencies on campus (ex: police, fire, paramedics, chemical, etc.) **CALL 5000.**
- Cell phone calls (626) 395-5000.

1.20.1 Fire

- Remain calm
- Alert others
- Close doors
- Evacuate to EAP: Lawn area just north of Keck.

1.20.2 Earthquake

- Remain calm
- Drop, cover, and hold
- Evacuate when shaking stops if building damage present

1.20.3 Shelter in Place when

- A chemical or biological spill
- Severe weather
- Or an armed individual on campus
    - For Keck individuals, when safe, take cover in the roof-top labs. Roof keys are possessed by Matt Johnson, Dr. Bill Johnson, Pam Albertson, and Christy Jenstad.

1.20.4 Biological, Chemical, and Radiological Incidents

- Ensure own safety before helping
- Attend to injured persons
- Confine the area
- Get help-notify Safety or Security
- Evacuate if necessary

1.20.5 Personal Injury

- Check the area for additional hazards
- Call 5000 and notify the supervisor
- Remove the injured/exposed individual from the area, unless it is unsafe to do so because of the medical condition of the victim or the potential hazard to rescuers.
- Report the exposure to EH&S.
- Flush contamination from eyes/skin using the nearest emergency eyewash/shower for a minimum of 15 minutes. Remove any contaminated clothing.
- Bring to the hospital copies of MSDSs for all chemicals the victim was exposed to.

Name:_____

TRAININGS RECEIVED

ID#:_____

General Lab Safety _____ DATE_____

Chemical Safety _____ DATE_____

Compressed Gas Safety _____ DATE_____

Furnace Safety _____ DATE_____

Beryllium Safety _____ DATE_____

Room 320

Glassblowing Safety _____ DATE_____

RF Safety _____ DATE_____

RDF Safety _____ DATE_____

Arc Melter Safety _____ DATE_____

Rolling Mill _____ DATE_____

Room 336

Spot Welder_____ DATE_____

Glass Safety _____ DATE_____

Room 326

Instron Safety _____ DATE_____

Lathe & Mill Safety _____ DATE_____

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