

**General Good Laboratory Practices (GLP)**

1. Do not consume food or drink, apply cosmetics or lotions or handle contact lenses in the laboratory.
2. Know where the following are located:
  - Emergency exits. Have an evacuation plan and several gathering locations to ensure all coworkers are accounted for since they could be somewhere in the facility other than the lab.
  - Fire extinguishers. (Use only if properly trained.)
  - Fire alarm.
  - Eyewash station. Ensure all stations are checked monthly.
  - Safety equipment / Personal Protective Equipment (PPE). Routinely inspect these items for wear.
  - Spill kits.
  - Electrical panel where laboratory power can be shut off in case of emergency.
3. Keep work areas clean and uncluttered to avoid spills, glassware breakage and cross-contamination.
4. Keep floors clean, dry and free of clutter to minimize trip hazards.
5. Work carefully, without rushing or running. Use the appropriate PPE.
6. Secure loose clothing and hair to avoid fires and upsetting equipment.
7. Organize work areas to promote good ergonomics, particularly for tasks involving repetitive movements or heavy lifting.
8. Wash hands before and after working in the lab and when taking breaks.
9. Never pipette chemicals by mouth.
10. Keep the lab locked when not attended so that it is not accessible to untrained staff or the public.
11. If possible, maintain a minimum of two lab personnel in the lab at all times so that they can watch out for each other. If not possible, consider having another staff member make regular checks of the lab.
12. Thoroughly clean glassware after use to avoid cross-contamination.
13. Dispose of needles and broken glass in separate sharps / broken-glass containers. Dispose of chemical waste in accordance with the applicable Safety Data Sheet (SDS) and local regulations.



## **Communication**

### **1. Safety Training.**

- All staff should be given training on GLP, PPE use, chemical handling, emergency response, and interpreting SDSs. A facility Chemical Hygiene Plan should be implemented and reviewed by all on an annual basis.

### **2. Chemical Inventory.**

- Every lab should have an inventory of all chemicals present in the lab. It should include the quantities, form and hazard information.
- Information contained in the inventory should be shared with first responders in the case of an emergency.

### **3. Emergency Contacts.**

- A list of emergency contacts should be posted in the lab and should include contact details for management personnel, fire, police, radiation-safety and hazardous-chemical responders. Emergency contacts should also be added to the contact list in all lab personnel's cell phones.

### **4. Chemical Labeling.**

- Chemicals still in their original containers should be labeled with the chemical name, the hazards they pose, the target organs and the manufacturer information. Use the Hazardous Materials Identification System (HMIS).
- Chemicals transferred to secondary containers should have, at minimum, the chemical name and, preferably, all the information listed for the original containers.
- Pre-labeled secondary containers are widely available from lab supply companies, and their use is encouraged.

### **5. Develop a Lab Safety Plan.**

- Once a plan is in place, staff should be trained on it, and the plan should then be read and signed. The plan should be reviewed and updated on an annual basis.



## Personal Protective Equipment (PPE)

Every lab should have the appropriate PPE on hand for the hazards present.

### 1. Eyewear.

- Approved (Z87 rated) eyewear needs to be used when handling chemicals and glassware.
- Whole-face splash shields should be used for dispensing bulk chemicals.

### 2. Shoes.

- Closed-toe shoes with glass-, chemical- and slip-resistant soles should be worn.

### 3. Gloves.

- Heat- / cold-resistant gloves should be provided for handling extremely hot or cold substances and chemical-resistant gloves for chemical handling.
- Soiled gloves should be discarded between procedures to avoid cross-contamination and unintended chemical mixing.

### 4. Respiratory Protection.

- Dust masks and respirators should be on hand to protect against respiratory hazards such as fine powders that may become airborne. Training, fit testing and medical clearance requirements need to be followed for all personnel using respirators.

### 5. Other.

- Lab coats and hair nets should be considered if lab procedures warrant them.

## Hazards Present in Brewery Labs

While not all hazards listed below may be found in all brewery labs, many will be.

1. Chemicals – toxins, flammables, caustics, corrosives, carcinogens, sensitizers.
2. Biohazards – antibiotics used to prepare microbiological media.
3. Pressurized gases – CO<sub>2</sub>, O<sub>2</sub>.
4. Electricity – damaged wiring, overloaded circuits, water.
5. Pressurized glassware / glassware under vacuum.
6. Fire.
7. Other physical – autoclaves, fume hoods, centrifuges, refrigerators / freezers, sharps / needles.



## 1. Chemical Safety.

The typical brewery lab will have more potentially hazardous chemicals present than the rest of the brewery in total. Although the amounts of these chemicals may be small, it is vitally important to know how to handle, store and dispose of these substances properly, in accordance with both local regulations and SDS information provided by the manufacturer.

- Do not store more chemicals than you reasonably need. If more than one chemical alternative may be used for a particular procedure, use the one that is the least hazardous and / or most effective in the smallest quantity.
- Store highly toxic chemicals separately.
- Store chemicals together in compatible groups. SDSs should provide guidance.
- Store chemicals that can ignite at room temperature in a flammables cabinet.
- Do not store hazardous chemicals above eye level. Non-hazardous chemicals stored overhead should be placed on shelves with a raised lip. Store heavy chemical containers on shelves near the floor, but avoid placing them directly on the floor.
- Do not store water-reactive chemicals under the sink or close to any water sources.
- Maintain a chemical inventory and SDS information for all chemicals in your lab. Understand how to interpret the SDS for every chemical stored and used in the laboratory.
- Use appropriate PPE when transferring, using and disposing of chemicals.
- Dispose of used and unwanted chemicals in accordance with the applicable SDS information and local regulations. Consider contracting with a Hazardous Waste Disposal company for removal of used and unwanted chemicals. To ship hazardous materials or waste, the shipper must have Department of Transportation (DOT) training, and for most labs, it is more practical to contract with a specialist. Waste Disposal companies can also give good guidance on the storage and disposal of used chemicals.
- Ensure all chemical containers are properly labeled.
- Chemical spills.
  - a. Minor spills, i.e., spills involving a familiar chemical that poses little danger to staff and that the operator knows how to clean up without impacting their health or the environment.
    - Alert co-workers.
    - Clean up. Have spill kits on hand before you need them.
    - Dispose of waste in accordance with the SDS.
    - Call emergency services if needed.



- b. Major spills, i.e., spills that put the health and safety of staff at risk and / or pose a serious threat to property or the environment. These spills require intervention from an outside agency.
- Alert co-workers.
  - Move staff to a safe location.
  - Call emergency services.
  - Guide responders to the location and give them the details of the spill.
- c. Mercury-containing instruments. Buy mercury-free thermometers and hydrometers to avoid having to deal with a mercury spill.

## **2. Biohazard Safety.**

The antibiotics used in making up microbiological media or in prepared media can be extremely toxic even in very small amounts.

- Precautions that should be taken include using gloves, eye protection and face shields.
- All glassware and surfaces that the antibiotics contact need to be thoroughly cleaned after media is prepared.
- Care also should be taken to wash your hands after handling antibiotics, particularly before eating.
- Eating or storing food where these antibiotics are being used or stored should be strictly prohibited.
- Contaminated needles represent another potential biological hazard via the spread of blood-borne pathogens.

## **3. Compressed Gas Safety.**

Gas cylinders can become missiles if punctured and, therefore, need to be treated with caution.

- Cylinders should be secured in an upright position with a chain or clasp, away from any objects that could fall and strike them.
- When moving cylinders, use a hand truck and secure the cylinder to it with a chain.
- Remove regulators and cap the cylinder when not in use.
- Ensure labels are maintained and do not store more compressed gas than is immediately needed in your lab.



#### **4. Electrical Safety.**

Electrical hazards are prevalent in brewery labs and can be exacerbated by liquids in sinks and vessels, by wet floors and counters and by heat sources. Commonsense precautions include:

- Never use equipment or power cords with damaged wiring. Inspect cords, outlets and power strips regularly.
- Do not stretch cords across floors and / or over equipment or sinks. If extension cords must be temporarily laid across floors, tape them down. Remember extension cords are not permanent wiring solutions, so consider having an outlet wired in closer to the appliance being used.
- Know where the circuit breakers are for your lab and know how to access and trip them in an emergency.
- Match extension cord capacity to the capacity of the power cord on the appliance you are powering.
- GFCI (Ground Fault Circuit Interrupter) outlets are required near water sources.
- Do not overload power strips, outlets and cords.
- Use only 15 amp power strips.
- Use only extension cords with three prongs and with a ground.
- If present in your lab, maintain a 3 foot clearance around circuit breaker panels.

#### **5. Glassware Safety.**

Glassware presents several hazards, including explosions, cuts and chemical cross-contamination. These hazards should be mitigated by venting glassware that may be pressurized or under a vacuum.

- Eye protection and heat-resistant gloves should be used if the glassware is heated or placed in any situation in which breakage may occur.
- Thoroughly clean glassware after use to avoid cross-contamination and inadvertent mixing of chemicals that could produce a toxic or explosive reaction.



## 6. Fire Safety.

The typical brewery lab features the potentially dangerous combination of flammable chemicals (iso-octane, acetone, ethanol, iso-propyl alcohol) and numerous ignition sources (gas burners, electrical sparks, friction from oscillating and rotating equipment), making fire safety a genuine concern.

- a. Small Fires: Small fires are those that are easily and immediately extinguishable and contained to a small area.
  - These fires can be extinguished by lab staff using a wet towel, an inverted beaker or a lid to smother or starve the fire of oxygen.
  - A fire extinguisher should be used for small but less-contained fires before they grow.
  - Contact emergency services regardless and evacuate the area.
- b. Large Fires: Large fires are those where the fire is already established and too dangerous for lab staff to extinguish.
  - For larger fires sound the fire alarm, evacuate all areas that could be affected and call emergency services.
- c. Points to Consider:
  - Have a fire extinguisher in your lab.
  - Know what type of fire your extinguisher is recommended for.
  - Know where your fire extinguisher is located and how to use it before you need it.
  - Keep fire extinguisher certification current.
  - If emergency services are called, meet them and let them know where the fire is located and inform them of any flammable, toxic or explosive substances that are stored in the area. Have your lab chemical inventory list to give them if you can safely get it.

## 7. Other Physical Hazards.

### Autoclaves.

Autoclaves present a number of potential physical hazards, including burns from direct contact with the autoclave itself or with hot items being autoclaved, burns from the steam exiting the autoclave when opened and exploding glassware during opening and unloading of the autoclave.

- Precautions to take include using only autoclave-safe glassware and insulated gloves, ensuring all containers placed in the autoclave are vented and standing well clear when the autoclave is opened.

**Centrifuges.**

The physical hazards associated with centrifuges are catastrophic failure of the rotor due to wear or imbalanced loading and failing to wait for the rotor to come to rest before reaching into the centrifuge.

- Maintaining the centrifuge in good working order, loading the rotor so that it is in balance (use a scale if needed) and waiting for the rotor to stop can mitigate the physical hazards.
- Do not slow or stop the rotor spinning with your hands while unloading a non-braked centrifuge. Take the extra time to let it come to a complete stop before reaching in.

**Fume Hoods.**

Fume hoods are designed to mitigate potential inhalation of toxic fumes. To do this, it is important that they are used correctly. Points to remember include:

- Turn on the ventilation fan while in use. Ensure vents are free of obstructions and that the materials you are working with are not preventing a free flow of air. Place large pieces of equipment on blocks to allow air flow underneath.
- Place equipment and materials as far back as possible in the fume hood. At minimum, materials and equipment should be at least 6 inches inside the hood.
- Keep electrical connections outside the fume hood.
- Don't make rapid motions while working in the fume hood that may result in air from the fume hood being forced from the hood into the room.
- Work with the sash as low as is practical for protection from splashes, fumes and explosions.
- Leave the sash 1 to 2 inches from closed when not in use.
- Fume hoods are not safe for chemical storage.

**Microwaves (if present).**

Microwave ovens, which are commonly used in brewery labs to heat microbiological media, present potential burn and explosive hazards.

- Precautions that should be taken include venting bottles before heating them and using gloves and eye protection while unloading.

**Refrigerators and Freezers.**

Refrigeration equipment can produce sparks and should not be used to store flammable or unstable chemicals. If such storage is imperative, a lab-safe refrigerator is required.

- Do not store food in lab refrigerators or freezers for obvious reasons. Foods should be stored in designated breakroom refrigerators or freezers.

**Needles.**

Needles used to collect microbiological samples come with the risk of spreading blood-borne illnesses.

- A separate sharps container should be employed to dispose of used needles.
- To avoid sticking oneself re-capping needles is not recommended.
- If re-capping is imperative, use the one-hand method. With one hand kept behind your back, scoop the cap off a flat surface with the needle, and seat the cap against the surface.