

Chemical Laboratory Safety and Security

A guide to Prudent Chemical Management

A chemical laboratory can be extremely dangerous for your safety and that of others if you do not lend caution.

The main causes of accidents in chemical laboratories are varied but can be largely traced to the following:

- 1) lack of knowledge
- 2) distraction
- 3) too much security
- 4) unconsciousness

The following table shows the main sources and types of common danger to which you may suffer if you not properly care for and will not work with appropriate caution.

SOURCE OF DANGER	TYPE OF DANGER
handling of hazardous chemicals	poisoning and even fatal poisoning, explosions, burns, wounds and burns to eyes, skin rashes, allergies, corrosion of equipment and clothing, ...
use of glass equipment	explosions, cuts, splinters, burns, ...
use of electrical	shock, fire, burns, shock, ...

In order to prevent accidents is absolutely essential to operate in a chemical laboratory, taking into account some basic precautions: most of them are normal rules of common sense, logic and education, others are more specific.

The rules here are not necessarily listed in order of importance, it is also possible that dangerous conditions may occur even outside the cases envisaged here.

1. **Be clear about the whole scheme of operations to be performed before starting any experience:** do not start any experiment if you have any doubts: program the whole sequence of operations to be done neatly and on time and prepare all the equipment to use.
2. **Do not block the passage ways or doors or areas where there are fire fighting equipments or safety doors or windows:** in an emergency you could verify that the premises should be evacuated quickly.
3. **Do not stay alone in a laboratory during dangerous procedures:** even a minor accident can become serious if you're alone and no action is taken immediately and decisively.
4. **Review the position of the main electrical panel and the secondary ones, fire fighting equipment, safety doors, valves that control water and gas:** in case of real danger, if you panic, it is more difficult to reason and find their position.
5. **Work in sufficiently ventilated areas:** many chemical reactions require reactive volatile products or develop dangerous products because toxic or irritating, so it is necessary to work in environments where such products are sufficiently diluted.
6. **Always warn in advance the laboratory manager and colleagues if you are allergic to certain chemicals:** perform a proper medical history during the sessions and check with the doctor responsible.
7. **If for any reason you feel a sense of discomfort, immediately move away from your working place, alert colleagues, neighbors and the laboratory manager.**

8. **Do not try to hide the effects of an accident even if considered mild:** the person who suffers an injury sometimes underestimates (or overestimates) it for psychological reasons. Always notify the laboratory manager and fellow neighbors. Among other things, the laboratory manager is obliged by law to notify the competent bodies in the event of an accident.
9. **Always notify the laboratory manager and fellow neighbors if you want to start an operation that can lead to some potential risk.**
10. **Wear a lab coat:** it is a fire protection and hazardous substances. It must be easily removable.
11. **Wear safety glasses:** the eyes are the most delicate part of the body and should be protected with impact resistant plastic glasses that are worn at all times because any injury can arise not only when performing dangerous manipulations but also as a result of dangerous operations carried out by other people. You must pay special attention especially when working with potentially toxic, flammable, explosive or which may give off vapors even irritating.
12. **Wear protective gloves when working with hazardous substances:** they are usually made of latex rubber and are disposable. Be careful, especially if they are wet, they can be slippery so it is easier to lose grip.
13. **Always read carefully the labels of containers prior to use its contents:** be absolutely certain of the identification of the substance in the container. Handle unknowns or mixing substances can be extremely dangerous. Each vessel must carry a label that clearly identifies its contents, at least the name and / or formula and precautions. In case of doubt absolutely do not use the contents of a container.
14. **Work under the fume hood, also wearing safety goggles, especially when using hazardous substances, toxic, organic solvents, acids and / or alkalis, or following reactions that develop toxic or malodorous gases or are exothermic and potentially explosive.**
15. **Do not consume food or beverages in the laboratory:** the greatest danger comes from the possible contamination of food or drink with toxic substances. Secondly, it is possible to occur the contamination of the reagents with food.
16. **Do not introduce foods or drinks into containers used for the experiments:** it is not sure that they are clean, and more, some chemical compounds can be absorbed by the glass and slowly released after some time.
17. **Do not smoke:** can the risk of fire because many solvents are flammable.
18. **Do not taste, or touch reactive compounds with hands or smell them:** many substances are irritating, caustic, poisonous, etc., and can also be absorbed through the skin. The effects can also occur after some time.
19. **It is strictly forbidden to take liquids with aspirating pipette by mouth:** always use automatic pipette or rubber aspirators: liquid may end up in the mouth, especially if air bubbles are formed, with potentially dramatic consequences.
20. **Wash your hands frequently and thoroughly:** often inadvertently, despite precautions, you can touch any residue which could then come into contact with the mouth or eye producing irritation or worse.
21. **Keep clean and tidy your workbench:** leave on the bench only the equipment necessary for conducting current experience. At the end of the experience store the equipment used after cleaning. Make sure you close the water tap and gas, if they were used.
22. **Remain in place and move only the bare essentials:** this is especially true if you are in a chemical reaction and if something is heating up. Do not turn in the laboratory and not touch the equipment is not known.
23. **Carefully use the glassware:**
 - you can take strong scalding because the hot glass is not visually distinguishable from the cold;
 - the glass can easily break into very sharp fragments.If the glass is hot, take it with tongs or gloves or with a rag or with a suitably shaped piece of paper. Warm up and cool down slowly the glass that might otherwise break. The fragments of glass are very sharp. To collect them use the same precautions employed for handling hot glassware. If an equipment is damaged, definitely not to use it and throw it into the broken glass collection container.

24. **When preparing a dilute solution of an acid or a hydroxide, start with concentrated acids or hydroxides, add these to water slowly, stir constantly, and never do the other way:** pay great attention especially when it has to do with concentrated H_2SO_4 or with NaOH or KOH solid: when these compounds are mixed with H_2O develops a large amount of heat and in consequence of this the solution is heated very quickly (exothermic reaction). Warning: the solution can reach the boiling point of almost instantly and begin to spill dangerously.
25. **Do not heat flammable liquids (i.e. organic solvents):** their gas could ignite.
26. **Do not face the opening of containers to other people because the liquid may splash.**
27. **Pay attention to electrical equipments:** do not touch electrical equipment with wet hands, make sure that no bare wires are under tension. In the case of potential danger, turn off the power supply from main electrical panel whose location must be known to all frequenters of the laboratory.
28. Do not keep any sharp objects like scissors, knives or glass tubes: in the event of a collision or fall can be dangerous.
29. **Who wears long hair, must try to collect them, to minimize the risk of getting caught, or ruin them with some reagent or drop them in some containers or, worse, to burn them.**
30. **Working on limited quantities of substances to limit the dangers in the event of an accident.**
31. **Never place containers, bottles or equipment near the edge of the table.**
32. **Grasp firmly and with all the necessary precautions when the containers containing the reagents must be moved from one place to another.** Do not keep them casually but support the containers by placing a hand on their bottom. Do not hold the bottle by the cap.
33. **Keep electrical appliances away from water:** in the event of contact of electrical parts with water you can get a shock.
34. **The chemical wastes should be disposed of according to the specific procedures provided by the Safe and Health Department.**