



Laboratory Waste

# Module 2

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Health & Safety  
**Essentials**

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# The segregation and disposal of hazardous laboratory waste

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It is the responsibility of all those working in a chemistry laboratory to ensure the safe disposal of hazardous waste that is produced during the course of their work. Furthermore, it is part of the COSHH assessment process that disposal of unwanted reactants and products are safely managed. Preparations for the safe disposal of hazardous chemical waste are available in the literature (see further reading). Some disposal information can be found on safety data sheets but in the absence of a clear procedure researchers should consult their institution's policy or their chemical health and safety officer. If you are unsure of the correct disposal route for a hazardous substance then ask.

## Managing hazardous laboratory waste

- Before starting an experiment you must know how to dispose of the waste produced in your reaction and, where appropriate, record this in your COSHH assessment.
- In general, where possible hazardous waste should be regularly removed from the laboratory to a secure hazardous waste storage area, ideally outside the building, to avoid a build-up of hazardous waste in the laboratory.
- Dispose of hazardous waste in the appropriate containers to avoid reactions between incompatible materials.
- Do not overfill containers.
- Ensure that hazardous waste containers are accurately and clearly labelled.
- Ensure that hazardous waste is stored in suitable containers (e.g. do not store acids or bases in metal containers; or hydrofluoric acid in a glass container)
- If small amounts (up to 2.5 litres) of certain wastes are stored in the laboratory then they must be stored in either a vented cupboard or a fume cupboard for safety and ease of access reasons (especially where there is a risk of exposure and a fire risk e.g. waste flammable solvent bottles).

## Segregation of waste in the laboratory

Segregation of different types of waste in the laboratory avoids reactions between incompatible materials. Separate containers for the following are standard in most chemistry laboratories:

- non-chlorinated (unhalogenated) organic solvents
- chlorinated (halogenated) organic solvents (>1% by volume halogenates)
- aqueous waste
- fine powders (e.g. waste silica)
- sharps
- glass
- general contaminated waste (e.g. gloves and paper towels)

For anything highly toxic or anything that doesn't fit into the categories listed above, consult your institution's disposal policy or chemical health and safety officer for advice. Clear labelling is essential as 'unknowns' cannot be disposed of.



## The disposal of chemicals

Certain chemicals e.g. common laboratory acids and alkalis may be disposed of down the drain with excess water for dilution. Particular acids DO require specific care and treatment (neutralisation), for example; Hydrofluoric acid (HF), acid chlorides (e.g. acetyl chloride), trifluoroacetic acid, chromic acid (although using it is questionable under COSHH as there are safer alternatives). However, unless you have explicit permission from your chemical health and safety officer, do not dispose of chemicals down the sink.

Compounds of the following elements should not be disposed of down the drain:

- antimony
- arsenic
- barium
- beryllium
- boron
- cadmium
- chromium
- cobalt
- copper
- lead
- mercury
- molybdenum
- nickel
- selenium
- silver
- tellurium
- thallium
- tin
- titanium
- uranium
- vanadium
- zinc

Mercury metal and mercury compounds should be collected separately in a suitable robust sealable container (e.g. a 20l plastic clip-top sealable bucket). The bucket must be clearly labelled and it is good practice to itemise the contents.

Heavy metals cations can be complexed with suitable anions or ligands to form insoluble precipitates that can be isolated and dried in preparation for collection by a licenced hazardous waste contractor.

## The disposal of other materials

### Organic Liquids

- Solvents** Waste organic solvents should be stored in labelled containers ('chlorinated' and 'non-chlorinated') to reduce the risk of chemical reaction and azeotrope formation. Waste solvents are usually disposed of via incineration at a licenced waste treatment facility.
- Oils** Oils, both mineral and synthetic, also cause severe problems in sewerage plants and must be transferred to licenced waste handlers. Waste oils, if carefully segregated according to type, are recoverable either as a recycled commodity, or as fuel oil.
- Solids** If solid waste is non-hazardous, it can be disposed of via the normal waste. The appropriate disposal method for solid hazardous waste depends on its stability, reactivity, and chemical nature. In general, hazardous solid materials that do not require further treatment can be bulked up for disposal via a licence contractor. Check with your Chemical Health & Safety Officer what packaging requirements are necessary.
- Glass** Glass waste must be stored in a labelled robust waste bin separately from other solid waste. Empty reagent bottles in good condition may be re-used after thorough cleaning and relabelling. Reagent bottles must not be placed in the waste bins without having been rinsed first, particularly if the residue is toxic.



- Sharps** Waste scalpel blades, syringes and needles are best stored for disposal in rigid containers. These containers should be collected by licensed disposal companies and incinerated with their contents in approved furnaces.
- Fine Powders** Waste fine powders (e.g. waste silica and alumina) can either be stored in rigid plastic containers or double bagged in plastic sealable bags to reduce the risk of exposure; inhalation can be harmful. Do not place fine powders in the general laboratory waste as there is a high risk of exposure to waste contractors and the public due to dust cloud formation, especially when the waste is transferred to the waste lorry ('dust cart'). Furthermore, should a container of fine powders be knocked over there is a potential for explosion as dust clouds can explode in confined spaces and / or in the presence of combustible particles when there is an ignition source.
- Resins** Synthetic resins and resin components should not be mixed with general non-hazardous waste for disposal. They should be placed separately in labelled containers indicating the possible hazards.
- Low Melting Point Alloys** Certain alloys used for laboratory casting activities with melting points of the order of 70 – 150°C contain significant quantities of cadmium. Waste material arising from these operations should not be mixed with other metal waste; instead it should be held separately for recovery or disposal by licensed waste companies.
- Nanomaterials** In general, 'free' nanomaterials should be bound in a matrix / on to a surface, dissolved in solution or agglomerated before being destroyed by incineration. As a precaution, nanomaterials are assumed to be harmful until proven otherwise. For further information see "*Working Safely with Nanomaterials in Research and Development*" by UK Nanosafety Group.

## Unknown wastes

It is not uncommon for laboratory chemists to stumble upon an unknown, unlabelled chemical. If this happens, you must assume that the chemical is hazardous and proceed with caution. Most chemistry departments are equipped with analytical facilities to identify the compound and the correct disposal route. It should be noted that determination of 'unknowns' is time consuming and costly; applying good laboratory management practices significantly reduces the chance of build-up of unknown hazardous waste.

