In-Laboratory Treatment of Chemical Waste

Segregate Non-Hazardous from Non-Regulated Waste

Many laboratories do not distinguish between waste that is hazardous and waste that neither poses a hazard nor is regulated as hazardous. If these different types of waste are combined, then the total must be treated as hazardous waste and the price for disposal of the non-hazardous portion increases markedly.

When safe and allowed by regulation, disposal of non-hazardous waste via the normal trash or sewer can substantially reduce disposal costs. This is the kind of waste segregation that makes economic as well as environmental sense.

The common wastes usually not regulated as hazardous include: certain salts (e.g., potassium chloride and sodium carbonate), many natural products (e.g., sugars and amino acids), and inert materials used in a laboratory (e.g., non-contaminated chromatography resins and gels).

These materials can be disposed of safely and legally in the normal trash or down the drain. This type of waste is not regulated because it does not exhibit any of the hazardous characteristics (ignitability, corrosivity, reactivity, or toxicity) as defined by BC Hazardous Waste Regulation, and is not listed as restricted or prohibited by the Metro Vancouver Sewer Use Bylaw, Consolidated.

For a list of chemicals that are considered non-hazardous visit the RMS Environment - Hazardous Waste Disposal Guide webpage.

Implement Chemical Waste Treatment in Your Lab

Concerns about environmental impact, bans on landfill disposal of hazardous waste, and limited access to sewer disposal have encouraged the development of laboratory hazardous waste reduction strategies.

The small-scale treatment and deactivation of products and by-products as part of the experiment plan is one approach that can be used by researchers to address this problem at the laboratory level. In-lab waste chemical treatment reduces transport and handling risks, and reduces the cost of collecting, storing and disposing of chemical wastes.

Some treatment suggestions for use in the laboratory are listed below. Use only the procedures specific to the waste you intend to neutralize. Note that some reactions in the examples below may produce hazardous compounds. Choose the safest method available and work carefully.

With the exception of neutralization, these processes are intended for treatment of small quantities, not more than a few hundred grams or millilitres. Larger quantities should be treated only in small batches. The generator must ensure that the procedure safely eliminates the regulated hazard(s) before the products are disposed of as non-hazardous waste. In addition, if the procedure suggests disposal of the product into the sanitary sewer, it must comply with the Metro Vancouver Sewer Use Bylaw No. 299, 2007 prohibitions and restrictions.

Acids and Bases

In most laboratories, both waste acids and waste bases are generated. Collect them separately and neutralize one with the other. If additional acid or base is required, sulfuric or hydrochloric acid and sodium or magnesium hydroxide, respectively, can be used. Sodium bicarbonate can also act as a neutralizer. If the acid or base is highly concentrated, first dilute it to a concentration below 10%. Non-toxic neutralization products may be disposed of through the sanitary sewer. Toxic products such as ones containing heavy metals and toxic ions such as cyanide and sulphide should be disposed of according to approved protocols.

Acyl Halides and Anhydrides
Acyl halides, sulfonyl halides, and anhydrides react readily with water, alcohols, and amines. They should never be allowed to come into contact with waste that contains such substances. Most compounds in this class can be hydrolyzed to water-soluble products of low toxicity.

Aldehydes
Many aldehydes are respiratory irritants, and some (formaldehyde, acrolein), are quite toxic. Some can easily be oxidized to the corresponding carboxylic acids, which are usually less toxic and less volatile. Hydrogen peroxide can be used for some oxidations.

Alkali Metals
Alkali metals react violently with water, common hydroxylic solvents, and halogenated hydrocarbons. The metals are usually destroyed by controlled reaction with an alcohol. The final aqueous alcoholic material can usually be disposed of in the sanitary sewer.

Amines
Acidified potassium permanganate efficiently degrades aromatic amines. The mixture is then flushed down the drain.

Inorganic Cyanides
Inorganic cyanides can be oxidized to cyanate using aqueous sodium hypochlorite (bleach). Hydrogen cyanide can be converted to sodium cyanide by neutralization with aqueous sodium hydroxide, and then oxidized.

Organic Peroxides and Hydroperoxides
Peroxides can be removed from a solvent by passing it through a column of basic activated alumina, by treating it with indicating Molecular Sieves®, or by reduction with ferrous sulfate. (These procedures do not remove dialkyl peroxides, which may also be present).

Metal Azides
Heavy metal azides are explosive and should be handled by trained personnel. Sodium azide, which is highly toxic, is explosive only when heated to near its decomposition temperature (300°C), thus heating it should be avoided. Sodium azide should never be flushed down the drain since the azide can react with lead or copper in the drain lines to produce an azide that may explode. Azides can be destroyed by reaction with nitrous acid.

Metal Hydrides
Most metal hydrides react violently with water with the evolution of hydrogen, which can form an explosive mixture with air. Some are pyrophoric. Most can be decomposed by gradual addition of methyl alcohol, ethyl alcohol, *n*-butyl alcohol, or *t*-butyl alcohol to a stirred, ice-cooled solution or suspension of the hydride in an inert liquid, under nitrogen. Although these procedures reduce the hazard of reactive metal hydrides, the products from such deactivation may be hazardous waste that must be treated as such on disposal.

Thiols and Sulfides
Small quantities of thiols (mercaptans) and sulfides can be destroyed by oxidation to a sulfonic acid with sodium hypochlorite (bleach).

Reference
The information above was extracted from "*Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*", National Research Council (1995).