Neutralization of Strong Acids and Bases

Although technically not waste minimization, neutralization of strong acids and bases can reduce the size of your laboratory's and KSU's aqueous waste stream. Neutralization is the most efficient and least costly way of managing waste acids and bases. This bulletin addresses the neutralization of the acids and bases listed below. After neutralization, waste liquids can be disposed of in the sanitary sewer.

Solutions that should not be neutralized

The solution you plan to neutralize should not contain heavy metals such as arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver. Wastes containing high levels of other metals may be of concern, as well.

Acids that are very reactive with water should not be neutralized, unless you have expertise in handling and using them. These include: acid anhydrides and chlorides; chlorosulfonic acid, fuming nitric and sulfuric acids; liquid halides of boron, silicon, tin, titanium and vanadium; and liquid halides and oxyhalides of phosphorus,
selenium and sulfur.

Due to extreme safety considerations, **you should also not attempt to neutralize hydrofluoric acid.**

Personal protection and equipment

Carry out neutralizations in a well-ventilated fume hood. Use the sash or a safety shield for protection against vigorous reactions. Wear a chemical resistant apron, splash-proof goggles or a full-face shield and nitrile gloves. Long gloves or gauntlets are also recommended. A five gallon polyethylene bucket is recommended for neutralizing 1-10 liters. A large container is needed in acid neutralization for addition of ice and base, and to safely stir the reaction.

Procedures

Neutralization of strong bases

1. Bases that may be neutralized include: solutions of potassium and sodium hydroxides, alcoholic sodium or potassium hydroxide cleaning solutions, ammonium hydroxide and ammonia solutions.
2. Dilute the base to a 5% (by weight) concentration or less.
3. Slowly add 6 N hydrochloric acid or other acid.
4. Monitor pH changes with pH meter or pH paper. (Note: Liquid indicators can oxidize rapidly in basic solutions and give false color change).
5. When pH is between 6 and 10, solution can be washed down sanitary sewer with 20 parts water.

Neutralization of strong acids

1. Prepare a 6 N solution of sodium hydroxide (240 g/ L) or potassium hydroxide (336 g/ L).
2. One liter of 6 N base can neutralize:

Acid	Quantity, mL

Acetic acid (glacial)	342
Formic acid (88%)	264
Hydrochloric acid	504
Hydrobromic acid (48%)	720
Hydriodic acid (47%)	1080
Hydrobromic acid (48%)	720
Nitric acid (70%)	378
Perchloric acid (70%)	516
Phosphoric acid (85%)	414
Sulfuric acid (96%)	166
Trichloroacetic acid (20% soln)	4902

3. Dilute the acid to a 5% (by weight) concentration or less (add acid to water, NOT water to acid). Use ice as necessary to cool the solution. Limit the solution to a maximum of 10 liters. Acids may generate heat upon neutralization.
4. Neutralize with 6 N sodium hydroxide or potassium hydroxide, adding it slowly.
5. Monitor pH with pH paper, a pH meter, or a suitable indicator.
6. When pH is between 6 and 10, wash solution down the sanitary sewer using 20 parts water.