



Guidance Note

May 2007

Acid Spills

HWG-025

This information is for your use and as a way of providing consistent information. There is no response required.

ACID SPILL PROCEDURE

For acid spills, the properly trained UCDHSC emergency coordinator should be aware of the following guidelines:

1. Restrict access into the spill area. Consider the potential for personnel exposures to the substance and decide whether the fire department should be called.
2. If spill involves a liquid, check the pH. Use the MSDS or chemical manufacturer's information as a guide and then determine appropriate PPE. Evaluate the spill site carefully for electrical hazards (acids are excellent conductors of electricity).
3. Diatomaceous earth (Ultrasorb 248) may be used on all liquid spills involving acids. NOTE: Individuals with greater knowledge and expertise may consider the use of baking soda or sodium carbonate for neutralization of acids. Be aware of carbon dioxide gas formation and possible airborne contamination problems when using neutralizing acids.
4. Use a plastic shovel or dustpan to clean up the acid and neutralizing agent. Collect the debris in a covered plastic bucket. Do not use metal containers since acidic materials tend to corrode metals. If the acid has been neutralized with carbonate based material, DO NOT seal containers until the neutralization reaction stops due to the carbon dioxide pressure buildup from the neutralization reaction. Decontaminate spill site with soap and water.
5. Once the clean up is complete, allow the room plenty of time to properly air out.
6. Properly label the waste container with a hazardous waste label including the date of accumulation. Leave a note on the waste container indicating the circumstances of the spill and notify the hazardous waste manager for final disposal.

General Overview of Acids

Acids have the ability to neutralize bases. In general, acid-base neutralization occurs when a hydrogen ion (H⁺) combines with a hydroxide ion (OH⁻) to produce water (H₂O). When acids are neutralized with baking soda or sodium carbonate, water and carbon dioxide gas is formed. Acids usually dissolve metals, and in the process generate flammable hydrogen gas.

Acids turn litmus RED. The pH range of acidic solutions is from 6.9 to 0. The stronger an acid, the lower the pH.

If the pH of an acid is less than 3, it should be considered very corrosive. It should be noted that both concentrated glacial acetic acid (98%) and a 0.01 molar solution (0.036%) of hydrochloric acid have the same pH of about 2. **The pH of a solution does not always provide sufficient information as to how much base will be required to neutralize the acid, and sometimes does not indicate how potentially hazardous the acid is.** The pH number scale indicates a ten-fold difference between adjacent units (pH 1 has ten times more hydrogen ion content than pH 2). Beware of false pH reading on non-corrosive liquids in the range of 3-4. For example, alcohol or oil are not corrosive substances, however when they wet pH paper they will give a false reading of approximately pH 3.



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Concentrated acids can cause serious burns to the eyes or skin. Proper eye protection and personal protective clothing must be worn to prevent burns. Dilute hydrofluoric acid (HF) on contact with the skin may not cause any pain. Hydrofluoric acid is very toxic by skin absorption and even minor skin exposures must be treated at a hospital with magnesium or calcium injections to prevent death.

Whenever deciding to neutralize acid spills with baking soda or soda ash careful consideration must be given to the consequences of the procedure. Both baking soda and soda ash produce carbon dioxide gas (bubbles) in the neutralization process, which may cause airborne contamination problems due to the acid being aerosolized. **ACIDS THAT CONTAIN RADIOACTIVE MATERIALS, INFECTIOUS AGENTS, OR TOXIC CHEMICALS SHOULD NOT BE NEUTRALIZED WITH BAKING SODA, SODA ASH OR OTHER GAS FORMING CHEMICALS!** Baking soda dissolved in water has a pH of around 8.3. Soda ash (sodium carbonate) dissolved in water has a pH of around 11.6. When using soda ash to neutralize acid spills you should be aware of the caustic nature of soda ash.

Although carbon dioxide gas is not particularly toxic, asphyxiation is a concern when the gas is allowed to accumulate in poorly ventilated spaces (STEL 30,000 ppm). Significant acid spills should not be neutralized inside cold rooms or inside tiny rooms with poor ventilation (carbon dioxide gas may displace all of the available oxygen and it becomes a hazard over 30,000 ppm) unless a self-contained breathing apparatus is used.

Consideration must be given to the salt that is formed when the acid is neutralized. When hydrofluoric acid is neutralized with baking soda, sodium fluoride is formed in the process. Sodium fluoride is toxic (rat poison) and large quantities of residue may be too toxic to dispose down the drain. Never mop up the neutralized residue from an acid spill if the salt of the acid is toxic. If nitric acid is neutralized with baking soda, sodium nitrate (oxidizer) is formed. It should also be noted that the sodium salt of monofluoroacetic acid is a P-coded hazardous waste. Acids which form toxic salts when neutralized (mercaptoacetic acid) or contain hazardous constituents should be absorbed with diatomaceous earth (Ultrasorb 248) for cleanup purposes. Do not neutralize chromic acid cleaning solutions with baking soda or soda ash. Hexavalent chromium is a human carcinogen and this material must not be inhaled.

A common misconception about neutralizing acid spills with either baking soda or soda ash is that after the acid has been absorbed with the base, the residue is no longer corrosive. **Acids absorbed in baking soda or soda ash will not be completely neutralized until the residue is dissolved in water.** When an acid is neutralized it forms the salt of the acid. The salts formed in the neutralization process may form a matrix into which the acid is absorbed, and therefore it cannot be fully neutralized. The residue from neutralized acid spills must be treated as a corrosive solid until it is hydrated with water. The spill residue must be collected in plastic containers which are open to the atmosphere because carbon dioxide gas may still be forming from the residue (pressure buildup may blow off the lid).

The following acids are gases at room temperature; hydrochloric acid, hydrobromic acid, hydrofluoric acid (BP 19.5 deg. C) and hydroiodic acid. These gases are dissolved in water to produce a liquid acid solution. Product containers holding saturated acidic gas/water solutions, must be handled with care because at elevated temperatures they may be under pressure. The solubility of a gas in water is dependent on the temperature, and at elevated temperatures the acid gas may be forced out of the aqueous solution. Concentrated acid containers must be opened in a functioning chemical fume hood.

Certain acids, namely fuming sulfuric acid (oleum) and chlorosulfonic acid, are extremely water-reactive. Fuming nitric acid may react violently with water or if in contact with organic materials.

Common Mineral Acids, strong

sulfuric* (H_2SO_4), phosphoric (H_3PO_4), hydrochloric (HCl), hydrofluoric (HF), nitric* (HNO_3), perchloric* (HClO_4), chromic* (H_2CrO_4)

* nitric acid, perchloric acid, chromic acid are all strong oxidizing acids.

* perchloric acid greater than 72% concentration may be explosive.

* concentrated sulfuric acid is water reactive, and fuming sulfuric acid is extremely reactive.

Nochromix cleaning solutions are prone to pressure build-up when freshly prepared. These solutions must be stored inside vented containers. Nochromix cleaning solutions consist of a persulfate oxidizer dissolved in concentrated sulfuric acid.



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Less Common Mineral Acids

hydrobromic (HBr), hydroiodic (HI), nitrous (HNO₂), sulfurous (H₂SO₃), phosphorous (H₃PO₃), hypophosphorous (H₃PO₂), perchlorous (HOClO), chlorosulfonic* (ClSO₃H), sulfamic acid (NH₂SO₃H)

* chlorosulfonic acid is extremely water reactive.

Organic Acids

formic (CHOOH), acetic (CH₃COOH), trichloroacetic (TCA, strong acid, CCl₃COOH), trifluoroacetic acid (TFA, strong acid, CF₃COOH), propionic (CH₃CH₂COOH), lactic (CH₃CHOHCOOH), butyric (CH₃C₂H₄COOH), carbonic (H₂CO₃), oxalic, strong acid (HOCCOOH), citric acid(HOOCCH₂C(OH)(COOH)CH₂COOH), maleic acid (C₄H₄O₄), mercaptoacetic acid (HSCH₂COOH)

Non-acidic chemicals (aromatic acids, fatty acids)

adipic acid, benzoic acid, picric acid, gallic acid, pyrogalllic acid, ascorbic acid (vitamin C), silicic acid (hydrated silica gel), uric acid, salicylic acid, phthalic acid, hypochlorous acid* bleach (HOCl), boric acid* (H₃BO₃)

* hypochlorous acid and boric acid are extremely weak acids.