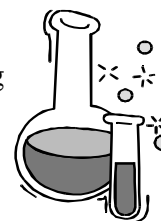


# MANAGING CHEMICALS From Hospitals and Biomedical Labs

## TREATING HAZARDOUS WASTE ON-SITE

Laboratories are uniquely prepared to treat some hazardous waste on-site for the purpose of reducing the total amount of hazardous waste they must track. Treating wastes may also eliminate the hazardous characteristics of waste chemicals. Many labs have saved thousands of dollars in disposal costs by using this waste management option. You can too!



Under certain conditions, the Washington State Department of Ecology (Ecology) encourages on-site treatment of hazardous wastes (also called 'treatment by generator'). Ecology's *Technical Information Memorandum (TIM) No. 96-412: Treatment by Generator* provides guidance on how to conduct these activities (<http://www.wa.gov/ecology/pubs/96412.pdf>). Six Focus Sheets providing treatment-specific guidance were published by Ecology in August 1993 and revised in 1996. They are:

- Carbon adsorption
- Elementary Neutralization
- Evaporation
- Filtration
- Separation
- Solidification

Copies are available from Ecology's Northwest Regional Office by calling (425) 649-7000 or through Ecology's website.

## Things to Keep In Mind

Treatment by generator must be done under the conditions listed in section -170(3) of the Dangerous Waste Regulations (WAC 173-303). If these conditions are not met, a Treatment, Storage and Disposal (TSD) Permit from Ecology is required. This is a serious consideration because TSD Permits are difficult to procure, involve a public hearing process and require reams of paperwork. If you can't treat your wastes according to the treatment by generator guidelines in TIM 96-412, disposal as hazardous waste is probably the best option.

The waste before treatment and, sometimes, after treatment, counts towards your facility's generator status. There is the chance that your generator status may go up but your waste disposal costs may go down.

Prior to treatment, regulated generators must notify Ecology on a Form 2 and in the Dangerous Waste Annual Report that they are conducting a treatment by generator process and whether the process is done according to the provisions of a specific Focus Sheet.

*(Things to Keep In Mind continued)*

A common misperception is that treating hazardous waste will reduce a lab's hazardous waste generator status. While it often saves money, treatment by generator won't reduce the amount of hazardous waste counted toward generator status. In fact, federal counting requirements mean that treatment by generator may slightly increase the amount of hazardous waste counted as generated while it reduces the amount of hazardous waste shipped out. This is because for annual reporting and generator status determinations, the total quantity (as wet weight) of waste generated prior to treatment and the weight of any remaining material that designates as hazardous waste after treatment must be counted. The waste prior to treatment and materials remaining after the process must be designated and managed properly.

Keep in mind that regulated hazardous waste generator labs (over 220 lbs./mo.) may need to change the training plans and contingency plans to cover the new treatment by generator process. Regulations by other agencies sometimes apply to treatment by generator activities (such as having an air pollution control permit for an evaporator, a Fire Department approved area for a still or a discharge permit from the sewer agency for effluent). Further treatment of the waste, at your expense, may be required if it is disposed of on land.

Staff in Ecology's Toxics Reduction Program can help you analyze whether treatment by generator is a good choice for your facility. They can even help determine if another agency's regulations will apply. Dennis Johnson ((425) 649-7040) can help you find a specialist in the Toxics Reduction Program.

## General Requirements Under Treatment By Generator

Small quantity generator labs (under 220 pounds per month of dangerous waste) are **encouraged** to follow the guidance in TIM 96-412. Regulated hazardous waste generator labs (over 220 lbs./mo.) **must** follow the guidance in TIM 96-412.

The following standards apply when treating wastes on-site:

- Keep a log listing the date and amount of each batch treated.
- The container in which treatment occurs must be marked with the date that the waste started to accumulate in it;
- The container must be emptied every 180 days (or every 90 days for those who generate more than 2200 pounds per month of dangerous waste or 2.2 pounds per month of toxic extremely hazardous waste);
- Storage containers for treating wastes must be in good condition, compatible with their contents, properly labeled, closed when not in use and inspected weekly;
- Where applicable, secondary containment to capture leaks and spills should be provided for wastes awaiting treatment;
- The treatment process cannot pose a risk to human health or the environment from fire, violent reaction, toxic mists, fumes, dust or gas, or damage to the structural integrity of the container holding the waste;
- After treatment is completed, the generator should check with local sewer or solid waste agencies prior to disposing of the treated waste.

*(General Requirements continued)*

By following the guidance in TIM 96-412, the generator can use any of the treatment methods described below or a method other than those listed on the Focus Sheets without Ecology review, written approval or a permit. However, if the method poses a risk to public health or the environment, Ecology may require the generator to stop treatment and get a permit.

The following are summaries from Ecology's treatment-specific Focus Sheets. Solidification is not discussed since it is rarely used by laboratories. See the section on Formaldehyde and Phenol Management (page 15) for an example of a treatment by generator method that is not listed in an Ecology Focus Sheet.

**Carbon Adsorption** binds soluble and gaseous substances to a surface such as activated carbon without altering them chemically. Activated carbon is "spent" when it has adsorbed so much contaminant that its ability to adsorb more is depleted. Carbon adsorption generally produces two wastes: a treated effluent and a spent carbon residual. Adsorption efficiency varies with the type of waste being treated.

Carbon adsorption works well for these compounds:

- Aromatic solvents (benzene, toluene, nitrobenzenes)
- Chlorinated aromatics (PCBs, chlorobenzenes, chloronaphthalene)
- Phenol and chlorophenols
- Polynuclear aromatics (acenaphthene, benzopyrenes)
- Organic pesticides and herbicides
- Chlorinated non-aromatics (carbon tetrachloride, methylene chloride, perchloroethylene)
- High-molecular weight hydrocarbons (dyes, gasoline, amines, humics)
- Chlorine, bromine, iodine, fluoride
- Antimony, arsenic, bismuth, chromium, tin, silver, mercury, cobalt

Carbon adsorption works poorly for these compounds:

- Alcohols, low-molecular weight ketones, organic acids, aldehydes
- Low-molecular weight aliphatics
- Nitrates, phosphates, chlorides, bromides, iodides
- Lead, nickel, titanium, iron, copper, cadmium, zinc, barium, selenium

Carbon adsorption is allowed when:

- Treated effluent and backwash are properly managed and disposed;
- Spent carbon is either regenerated appropriately or is properly designated and disposed;
- Spills and releases are cleaned up immediately;
- Equipment is decontaminated as needed;
- Contact time with the carbon is sufficient to allow adsorption of contaminants.

**Evaporation** is allowed when:

- Only inorganic waste mixed with water is treated;
- All vapors are captured;
- Some water is left to prevent "over-cooking" of sludges;
- Sludge residues are properly disposed;
- Secondary containment is provided for the evaporator.

*(General Requirements continued)*

**Filtration** is primarily used in labs to remove undissolved heavy metals present in suspended solids. Labs may treat wastes by filtration provided:

- The filtration equipment and its connection to the tank or container are totally enclosed;
- The dewatered liquid filtrate and washwater from the process are designated and properly managed;
- The filter cake and filter media are designated and properly managed;
- Spills and releases are minimized and immediately cleaned up;
- All equipment is decontaminated as needed.

**Separation** includes those processes that separate solids from liquids and separate liquids of different densities. All separation processes must meet these criteria:

- Agents that precipitate, flocculate and emulsify the waste must not change its chemical structure except to form a precipitate;
- Processes cannot produce toxic or flammable gases unless all vapors are captured.

Separation methods include:

- *Air flotation*: Separating solids from liquids by floating solid particles on air bubbles to the surface for skimming, often after flocculation;
- *Centrifugation*: Separating different density materials through high speed spinning, typically in a centrifuge;
- *Flocculation*: Forming clumps of suspended ultra-fine particles through sedimentation, air flotation or filtration, often using a liquid polymer;
- *Decanting*: Separating materials of different specific gravities, often after flocculation, so that the clarified liquid can be removed;
- *Demulsification*: Breaking stable emulsions with an additive that creates discrete layers, which are then separated through decanting;
- *Ion exchange*: Removing metal cations and other ion solutes, typically through resin columns, in exchange for non-hazardous ions such as calcium;
- *Oil skimming or phase separation*: Separating multi-component liquids with different specific gravities that are unable to mix, such as oil and water;
- *Precipitation*: Forming an insoluble precipitate from dissolved materials by adding chemicals;
- *Sedimentation*: Settling out suspended solids by gravity.

**Elementary neutralization** is a process used to adjust the pH of a substance to between 6 and 10. It can only be used on substances that designate as dangerous wastes because of the characteristic of corrosivity. Corrosive dangerous wastes, as defined by the Dangerous Waste Regulations, are liquids with a pH less than/equal to 2 or greater than/equal to 12.5; liquids that corrode steel at specified rates; and solid wastes that, when mixed with an equal weight of water, result in solutions with a pH less than/equal to 2 or greater than/equal to 12.5.

All elementary neutralization processes must meet the following criteria:

- Be done in accumulation tanks or containers by trained personnel;
- Produce residuals that exhibit a pH > 2 and <12.5 prior to on-site management or disposal or a pH that meets local sewer discharge requirements;

*(General Requirements continued)*

- Don't pose a risk to human health or the environment;
- Result in proper management and disposal of treatment residuals.

Neutralizing large volumes of concentrated mineral acids is not recommended because the process produces heat and fumes that can pose safety risks. The following procedure is based on guidance from the book Hazardous Laboratory Chemicals Disposal Guide by M.A. Armour (CRC Press, 1991):

- When neutralizing acids, staff should wear personal protective equipment, including a lab coat, plastic apron, nitrile gloves, goggles and a respirator with acid gas cartridges. Small quantities of the acid should be carefully added to a large volume of stirred ice water. By adding a solution of sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) to the ice water, the pH can be adjusted to between 6.0 and 9.0. A meter or litmus paper can be used to measure the pH. When the pH is correct, the solution can be drained to the sanitary sewer followed by a water rinse at least fifty times the acid's volume.


Elementary neutralization can be accomplished passively by using an acid neutralization tank. Under this procedure, acid-resistant piping is connected to a storage tank partially filled with limestone chips. As corrosive liquids pass through the limestone, they are neutralized.

Drawbacks of this method include:

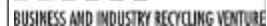
- Tanks are rarely maintained;
- Sulfuric acid reacting with the limestone creates a slime layer that reduces the effectiveness of the treatment process;
- There is a possibility that hazardous liquids will be discharged to drains because staff may assume that the tank treats all liquid wastes;
- Sediments will need to be characterized and properly disposed.

*This fact sheet was created by the Medical Industry Waste Prevention Roundtable as part of a seminar series designed to help medical industry professionals control costs through product stewardship and waste reduction. Please pass this sheet on to others who maybe interested.*

## Medical Industry Waste Prevention Roundtable

 What is the Medical Industry Waste Prevention Roundtable? The Roundtable was established in early 1999 to bring together medical industry professionals who are interested in exchanging ideas on, and developing new ways of, preventing and reducing waste. During 2000 and 2001 the group is hosting a series of seminars to develop cost-effective, environmentally sound solutions for managing major medical wastes such as products and packaging.

The Medical Industry Waste Prevention Roundtable is sponsored by:



For more information on the Roundtable, visit our Web site at [http://dnr.metrokc.gov/swd/bizprog/waste\\_pre/medical.htm](http://dnr.metrokc.gov/swd/bizprog/waste_pre/medical.htm) or contact Kinley Deller at (206) 296-4434 or [kinley.deller@metrokc.gov](mailto:kinley.deller@metrokc.gov).

