

COMMERCIAL LABORATORIES:
INTRA-LABORATORY METHODOLOGIES

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There are three issues to consider when discussing waste management in any kind of laboratory—commercial, clinical, academic, or research. These are regulatory constraints, liability, and fiscal considerations.

The Resource Conservation and Recovery Act (RCRA) of 1976 was passed to protect human health and the environment from the improper management of hazardous wastes. Protection of human health and the environment was to be accomplished by "cradle to grave" tracking of hazardous wastes through the use of a manifest. When RCRA was enacted, it was geared toward the large quantity generators, those generating more than 1,000 kilograms per calendar month. The small quantity generator was exempt from RCRA provisions.

Waste Minimization Efforts Are Mandated

The Hazardous and Solid Waste Amendments of 1984 made up some of the most significant legislation passed regarding hazardous waste management. These amendments, first, reauthorized RCRA. Secondly, they required the regulation of small-quantity generators, and this extended coverage to a lot of university and other smaller institutional laboratories. It required the re-evaluation of listed hazardous waste including new land disposal restrictions. This has changed the way we dispose of a lot of our hazardous waste and the way we manage it both on-site and off-site. Finally, the Hazardous and Solid Waste Amendments require waste minimization for both large- and small-quantity generators. On the manifest that must be signed for hazardous waste shipped off-site there is a clause by which the person signing confirms that the company or institution has made efforts to minimize waste.

One Way to Minimize Liability Is to Minimize Waste

Liability affects the ways in which we manage our hazardous waste. We can minimize our liability by doing the following:

- * utilizing environmentally sound waste management practices
- * minimizing the transportation of wastes (If you can recycle on site or use volume reduction techniques, you can reduce the volume of waste you have to transport.)
- * choosing a reputable hazardous waste management company (There are a number of companies that claim to be hazardous waste management companies when they are actually "brokers" or middlemen who simply hold wastes and hope that they can come up with ways of disposing of it, so check out the company that you use very thoroughly.)
- * utilizing waste minimization technologies on-site

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Letting Disposal Cost Dictate Disposal Method Can Be False Economy

Everyone is concerned with the cost of hazardous waste management, and cost seems to be the determining factor in evaluating and choosing a waste disposal method. However, letting cost be the deciding factor can be false economy if there is a slightly more expensive method that reduces your liability. You can dispose of your waste at a minimal cost in a landfill, or you can dispose of it by incineration at a higher cost. But, several years down the road, if that landfill should become a Superfund site or if there should be a leak or other incident, you will pay many times the original disposal fee in clean-up costs. The best way to reduce disposal costs is to reduce the amount of waste you dispose of by using waste exchanges, recycling techniques, and waste reduction.

Past Practices and Attitudes Regarding Hazardous Waste Are No Longer Valid

In the past, we've looked to landfill disposal as the number one disposal method because we have had the out-of-sight, out-of-mind mentality. That will no longer hold up. There is a great deal of long-term liability associated with landfilling, and we cannot simply forget about the wastes we place there.

In the past, we have purchased chemicals in large volumes because they were cheaper that way. If there's been a sale on a case of acetone, we may have bought a few gallons when we only need a few hundred milliliters. A substantial portion of a large-quantity purchase may just sit in the laboratory until eventually it must be disposed of. Today, there is a significant cost associated with disposal of that unused chemical.

In the past, we have not been strongly motivated to try new technologies. Now, regulations mandate that we try to reduce our hazardous wastes.

Buy Only the Quantity of Chemicals You Need

One way to begin to solve waste disposal problems and reduce waste disposal costs is to buy only what you need rather than large quantities because it is cheaper. You can't always consider just the unit cost in trying to make economical chemical purchases. As examples from the American Chemical Society's publication "Less Is Better" illustrate, you must take into account the cost of disposing of unused chemicals to reach a true total cost. There is a chemical supply company that will package in any quantity that you require most of the chemicals they supply. With this service, you can order the exact amount of almost any chemical you need.

Recycle Wastes

Another way to solve waste disposal problems and reduce waste disposal costs is to implement waste minimization technologies. Among these technologies is recycling. Recycling can include several practices, including waste exchanges. Waste exchanges can be intra-facility, in which your company sets up a system—perhaps circulation of a computer printout of available chemicals or newsletter or bulletin board notices—letting people know what's available. There are regional waste exchanges, which are set up primarily for large commercial users of chemicals, the nearest of which is the Southeast Waste Exchange in Charlotte.

Recycling can also refer to recovery of chemicals. Solvents can be distilled on-site and reused, or they can be sent off-site for distillation and returned to you for reuse. Off-site distillation can be applied to commercial grade chemicals—things like paint thinners that do not require high purity—or to laboratory reagents in which high purity is required. You can substantially reduce the quantity of solvents you have to purchase through recycling, and you can almost eliminate the disposal costs associated with solvents and greatly reduce the liability associated with disposal. The "still bottoms" are regulated and must be disposed of, so there is some remaining liability associated with disposal of "still bottoms," unless you send them off-site for incineration. Your liability associated with transportation is also reduced.

On the other hand, you can only send large-volume (several 55-gallon drums), single-component solvent waste off-site for distillation, and, of course, you have to pay for distillation. Also, there is still liability associated with transportation because you are shipping the solvent off-site and it is being shipped back to you. Therefore, you will want to weigh the advantages and disadvantages of off-site distillation against the advantages and disadvantages of on-site distillation. If you distill waste solvents on site, you have costs associated with equipment purchase and maintenance and personnel to operate the still.

Precious metals can also be recovered from wastes. Waste containing metallic mercury—from broken thermometers or barometers, for example—is difficult to dispose of. There is a company in Pennsylvania called Bethlehem Apparatus which redistills and recycles mercury. They handle both small quantities from laboratories and large quantities from industry.

Silver in laboratory or photographic wastes can be recovered. For lab wastes, the recovery can be incorporated into the actual procedure that generates the waste. A few added steps at the end of the procedure will recover silver in the form of silver powder or silver nitrate, depending on the number of steps utilized, from waste. The recovered material such as silver nitrate, which is a fairly expensive reagent, can then be used in subsequent experiments. Silver can be recovered from photographic solutions by electrolytic recovery or chemical recovery cartridges which are available from Kodak. If you have large quantities of X-ray film you can sell it to brokers who will pay you for the silver in it and ship it off to have the silver recovered.

Process Modification Can Also Reduce Hazardous Waste Quantities

Another area of waste reduction technology is process modification. This refers to the utilization of less hazardous or non-hazardous chemicals in place of hazardous material. For example, in an experiment calling for benzoyl peroxide, an organic peroxide which poses a problem from waste disposal companies. However there was an experimental method available which utilized hydrogen peroxide, which is a great deal easier to dispose of than benzoyl peroxide.

Process modification can also refer to the utilization of alternate procedures to accomplish the same goal and to the reduction of the quantity of hazardous material used for a specific procedure. You can scale down procedures in any laboratory to use very small amounts of chemicals.

Volume reduction refers to three areas: neutralization, precipitation, and inactivation of wastes. Neutralization is applicable to small quantities of certain acids and bases, primarily mineral acids and bases such as sodium hydroxide and potassium hydroxide. Neutralization can generally be

accomplished in a simple two-step procedure which most labs are capable of doing.

Precipitation is applicable to small quantities of inorganic heavy metal compounds and their aqueous solutions. It does not eliminate the hazardous component of a waste, but it does minimize it. It separates out the hazardous component of a waste so that the remaining waste, generally aqueous, can be disposed of through the sanitary sewer.

Inactivation is applicable to small quantities of carcinogen wastes, antineoplastic wastes, and hazardous pharmaceutical wastes. It involves the transformation of a hazardous material to a non-hazardous material by a chemical reaction or a series of chemical reactions. It is important to verify that the material you are trying to inactivate has actually been destroyed before you dispose of the material down the sanitary sewer.

Finally, energy recovery refers to recovering energy primarily from waste solvents in the form of a fuel supplement. There is a company in Virginia called Oldover Corporation which has made a big business of energy recovery. Energy recovery should be considered as a waste minimization alternative if distillation is not applicable to your waste stream. It requires wastes that have a high BTU value and low water and halogen content. It is cost efficient for as little as one or two 55-gallon drums of solvent waste.

As a generator of hazardous waste you have a responsibility to seek the most appropriate environmentally sound management methods. Among these are reducing the amount of waste that is shipped off your site by employing waste reduction technologies and eliminating the land disposal of hazardous wastes by seeking alternative management options.

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