

Campus Pollution Prevention and Waste Minimization Guidelines

Based on a document provided courtesy of the University of Wisconsin at Madison

Featuring Key Topics:

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The methods in this *Guide* not only prevent pollution, but can also reduce the risk of chemical exposure and accidents.

Campuses create pollution by making hazardous waste, by allowing organic solvents to evaporate and be exhausted in fume hoods, and by discharging certain hazardous materials down the drain. This *Guide* will help you minimize the environmental impact of your waste-producing operations.

It may be difficult for your operation to minimize its waste. By its very nature, research is often the process of studying something and throwing it away. Unlike larger industrial processes, the multitude of irregular laboratory operations are intrinsically more difficult to control. Still, there are many things you can do to prevent pollution and minimize hazardous waste both in your laboratory and in other campus operations.

Once you have done what you can to prevent pollution, try to reduce environmental risks in other ways and follow those practices that have the least impact on the environment. This *Guide* describes how.

PREVENT POLLUTION

A variety of methods can be used to prevent pollution to the air, water or land. There are two categories of pollution prevention: methods that reduce pollution at the source (the laboratory or other campus operation) and environmentally sound recycling.

Air and water pollution cost health and the environment in indirect ways. Hazardous waste disposal costs the University directly. Not including labor and operating costs, the University of Maryland spends nearly \$100,000 annually to safely dispose of chemical waste commercially. Each carboy costs up to \$20 to dispose of; disposal of *one* lecture bottle (a small gas cylinder) can cost up to \$1,600. So when you prevent pollution, you also reduce costs.

EPA defines *pollution prevention* as:

- ! source reduction; and
- ! environmentally sound recycling.

Reduce Pollution at its Source

Changing practices and processes to prevent pollution at its source is referred to as *source reduction*. Source reduction methods include process modification, improved operation and material substitution. Some businesses can prevent pollution by modifying their product, but this method is not as applicable at an educational institution.

Source reduction includes:

- ! modifying processes;
- ! improving operations;
- ! substituting materials; and
- ! modifying products.

Modify Processes

Pollution can be prevented by changing the process by which the pollution is created. In the laboratory, modern extraction techniques, (such as those that use a solid phase or supercritical fluid) minimize waste by using much smaller volumes of organic solvents. Computer simulations and modeling eliminate all environmental impacts when they are substituted for wet laboratory experiments. In the classroom, computer and multimedia

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simulations often allow students to observe more complex procedures than would be available by a traditional laboratory exercise. Around campus, paint can be removed from structures using heat guns rather than chemical solvents to reduce chemical waste.

Reduce the Scale of Laboratory Processes. One of the most successful pollution prevention modifications is reducing the scale of laboratory procedures. Innovative laboratory glassware and microscale techniques are now available that reduce quantities used to milligrams. Reducing the scale of laboratory processes not only prevents pollution, but has many other benefits:

- ! Small scale experiments cost less because they use less chemicals--valuable raw materials are also conserved;
- ! Small scale experiments usually run more quickly;
- ! Heating and cooling is easier with smaller volumes;
- ! Your exposure to chemicals is reduced; and
- ! The amount of fugitive emissions (evaporative losses) will be reduced.

Improve Operations

Pollution can be prevented by improving waste-producing operations. Creative thinking can help you redesign procedures to use less chemicals, create less waste, prevent fugitive emissions and minimize unnecessary discharges to the sanitary sewer.

Careful and neat operations reduce waste. Take care when weighing or transferring chemicals between containers to minimize spills. Don't take fume hood emissions, sewer effluents or chemical wastes for granted. Chemical releases and disposal affect the environment, and should be minimized when practical. When it can be done safely, seal and contain processes to prevent the escape of fumes or leaks to the environment.

Less is Better. The American Chemical Society (ACS) urges people who work with chemicals to adopt the motto "Less is Better." (A copy of ACS's booklet, *Less is Better*, can be obtained from the Department of Environmental Safety). It is safer and more environmentally sound to buy less, store less, use less and dispose of less. Less reduces risks to you and your colleagues. Less reduces the risk of an accident or fire. Less saves space and money. Less prevents pollution.

- ! *Buy less.* Purchase only the chemicals and amounts that you need in the immediate future. If you need only a small amount, ask another user if you can borrow their stocks. There is no such thing as a "large economy size" of a purchased chemical. A bulk quantity may appear to be economical, but the cost of disposing of the excess will likely negate any savings. Don't purchase chemicals speculatively. Some chemicals age and degrade more rapidly than others, and become waste. Avoid end-of-budget-year buying sprees. Do not accept gifts or samples unless you plan to use them in the immediate future. Do not accept more than you need. These practices minimize chemical waste because a significant portion of the University's hazardous waste is unwanted surplus chemicals. Unfortunately, because of unnecessary purchases, many chemicals with factory seals are shipped to be incinerated each year.
- ! *Store less.* Storing excess and duplicate chemicals risks a fire, spill or leak. Some chemicals become reactive or explosive with age. Fugitive emissions from stored chemicals can lead to a harmful exposure. Storage of surplus takes up valuable space. Excess stored chemicals exacerbate a spill, leak or release, and add risks when responding to a fire. These are all

Simple process improvements can prevent pollution:

- ! minimize the amount of chemicals used;
- ! be neat when using chemicals; and
- ! keep volatile chemicals capped and sealed.

Less is better! Buying smaller amounts of chemicals means:

- ! fresher stocks;
- ! reduced exposures;
- ! reduced emissions;
- ! less surplus to dispose of; and
- ! fewer accidents.

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good reasons to buy less, and good reasons to regularly review your chemical stocks and dispose of surplus. Contact the Department of Environmental Safety to find out how to get help with a laboratory cleanout.

- ! *Use less.* As discussed above, using less chemicals is safer for you and the environment.

Visit the Department of Environmental Safety's **Chemical Exchange Page** at www.des.umd.edu

Help Redistribute Surplus Chemicals

You can obtain surplus chemicals that we will deliver to your laboratory, at no cost to you. When you locate at least a gallon of a chemical you would like to obtain on the **Chemical Exchange Page**, simply contact us at (301) 405-3990 for free delivery.

Use Surplus Chemicals. Before ordering that new stock of chemicals, check the **Chemical Exchange Page** to see if you can get what you need for free. If you find what you need, simply follow the directions on the screen for prompt service. If you don't see what you're looking for, please check back periodically—our list of surplus chemicals is constantly growing and changing as we improve our program.

Redistribute Your Surplus Chemicals. Redistribution works with chemicals that have not degraded with age. So, please review your chemical inventory regularly and add your surplus chemicals to the **Chemical Exchange Page**. This will make your surplus chemicals available for use by other laboratories. Simply follow the instructions on the screen to register your surplus inventory.

A Success Story. The University of Wisconsin - Madison Safety Department's laboratory chemical redistribution program has been in existence since 1980. About 30% of each quarterly surplus chemical list is redistributed, which saves the University \$10-20,000 in the cost of chemical disposal.

You receive free laboratory chemicals. We reduce the amount of chemical waste that needs to be disposed. The whole University benefits!

Control Your Chemical Inventory. As described above, a significant amount of campus hazardous waste is the result of disorderly chemical inventory practices. Duplicates are purchased because chemicals are not stored carefully and records of the current inventory do not exist. Labels fall off of older containers, which creates unknowns that are expensive to analyze and dispose. Because of careless use and inventories, users are reluctant to share chemicals, so storage shelves often hold half-filled bottles that will eventually be disposed of as hazardous waste. Worse yet, some chemicals become unstable, reactive and explosive with age. If you are not monitoring expiration dates and chemical stocks, your safety is at risk.

You can end these problems by controlling your chemical inventory. Keep an inventory of your chemicals on a card file or computer database. This works best when you:

- ! Put one or two people in charge of purchasing new chemicals and maintaining the inventory--some users may prefer to rotate this responsibility monthly;
- ! Mark or code chemical containers to correspond to an identifier in the database--also, date each incoming container;
- ! Because of their small size and great number, samples are usually omitted from the inventory (make sure samples are marked properly, however);
- ! To keep the system manageable, some users may prefer not to inventory containers smaller than 100 grams unless highly reactive, toxic or valuable;
- ! Devise a system of identifying chemical storage areas and mark them--include this location in the database or cardfile;
- ! Rotate stock--follow the principle of first-in, first-out;
- ! Keep track of expiration dates and storage times, especially for peroxide-formers and other degradable chemicals; and

Many vendors sell chemical inventory software.

See the **Hazardous Waste Management** section in the 1997 *University of Maryland Hazardous and*

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Regulated Waste Procedures Manual for labeling guidelines.

- ! Keep track of emptied containers and waste disposal to remove chemicals from the database or cardfile.

Where Does It Go?

You purchase and use chemicals, but where do they go? The *UM Waste Disposal Guidelines Wall Chart* describes chemical disposal procedures. But if you added up all your chemical purchases, and subtracted all the waste you give to the Department of Environmental Safety, chances are much will be unaccounted for.

The best way to assess your operation's impact on the environment is to conduct a *mass balance*. Choose one chemical, such as an organic solvent, and account for purchases and disposal. Then try to determine where the rest goes.

Stored solvents can evaporate, be emitted to the air, and may contribute to air pollution. Poorly capped volatile organic solvents stored in a fume hood can disappear overnight. Does yours? A rotary evaporator will draw solvents into the sanitary sewer. You start your procedure with a certain amount of solvent. How much of it ends up in the waste solvent carboy?

You're breaking new ground—there hasn't been much research in this area. The Department of Environmental Safety occasionally tests building air emissions and sewer effluents, but the irregularity of campus operations make a University-wide mass balance difficult. We'd appreciate hearing what you discover about your operations.

A chemical *mass balance* is the first step in assessing your operation's impact on the environment.

Reduce Air Emissions. One potential source of pollution from campus operations is the emission of volatile chemicals into the air. To prevent chemical exposure to personnel, many operations are designed to include fume hoods, local ventilation, ventilated cabinets and room ventilation. The exhaust of these systems is often not filtered or controlled for volatile chemicals, fumes or gases. As a result, you should use these ventilation systems to protect you from chemical exposure, but you must use them prudently to prevent excessive air emissions of chemicals. Evaporation of laboratory organic solvents alone contributes significantly to the University's toxic releases. It is obvious when an organosulfur compound escapes into the atmosphere, but most chemicals do not have such a low odor threshold to indicate their release.

Simple management practices can minimize air emissions:

- ! Keep containers of volatile chemicals capped--if a cap is not tight, replace the cap or transfer the contents to another container;
- ! The best container seals have an even rim on the bottle and an appropriately-fitting cap with a polyethylene or teflon liner;
- ! Minimize the amount of volatile chemicals in your area (order and store only what you need in the immediate future and use the **Chemical Exchange Page** on the web to redistribute your surplus);
- ! Do not store chemicals in the fume hood (use a ventilated cabinet, which has only a slight negative pressure and is less likely to draw volatiles into the air);

Fugitive Emissions are the inadvertent evaporation of volatiles to the atmosphere.

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To reduce air emissions, keep containers of volatile chemicals closed.

Fume Hoods, Energy and the Environment

Fume hoods are energy wasters. On average, it costs \$2,500 a year to operate a fume hood because it exhausts conditioned air—warmed air in the winter and cooled air in the summer. Pollution is a byproduct of energy generation and use. So, to prevent pollution, we want to conserve energy.

Fume hoods are invaluable safety controls. When you use a toxic chemical in a fume hood, it can protect you from a harmful exposure.

The resolution to this conflict is to use fume hoods wisely. Avoid using a fume hood for chemical storage whenever possible; keep it clear for work. Instead, use a ventilated storage cabinet that draws less conditioned air.

If you help design or remodel a laboratory or other chemical-handling space, consider local exhaust systems (such as a bench-top exhauster) for routine operations. They often provide protection at lower cost, use less energy and make unencumbered workspaces.

Provide us your thoughts on more efficient use of fume hoods so we can minimize our emissions.

- ! Keep processes involving volatile chemicals as closed as safely possible;
- ! Consider performing procedures in a glove bag instead of a fume hood--glove bags may be more effective in the prevention of exposure and will minimize fugitive emissions;
- ! Keep waste solvent collection carboys capped at all times, unless you are adding waste;
- ! To minimize the amount of waste solvents in your lab, routinely dispose of carboys by requesting a waste pick-up through the Department of Environmental Safety's web site (at a minimum, request a pick-up for disposal within three days of filling a container);
- ! Do not dispose of any chemical by evaporation--it is illegal to evaporate hazardous chemical waste for the purpose of disposal; and
- ! Do not dispose of any gas by venting.

Keep operations using volatile chemicals as closed as safely possible.

Wasteful energy use results in unnecessary pollution. Your efforts to conserve energy prevent pollution.

Reduce Wastewater Effluents. To reduce the potential for unwanted discharges to the sanitary sewer system, remember to:

- ! Make sure containers of liquids are not leaking ;
- ! Make sure systems that create wastewater do not leak or have inadvertent or unnecessary discharges;
- ! Make sure liquids are stored in trays, other containers or diked areas with no floor drains so that spills are contained;
- ! Work with others in your area to limit sewer discharges; and
- ! Do not dispose of any waste into a storm sewer--most outside drains and sewers are storm sewers that discharge directly into surface waters.

Substitute With a Safer Chemical

One of the most successful ways to prevent pollution is by substituting a hazardous chemical with a less hazardous chemical. For many operations, an environmentally sound alternative exists.

Use Non-ignitable Liquid Scintillation Cocktail. One excellent pollution prevention practice is substitution of non-ignitable liquid scintillation cocktail (LSC) for toluene-based cocktails. This substitution reduces the risk of laboratory fire and personnel exposure from toluene. Toluene-based cocktails must be incinerated as a hazardous waste. Most non-ignitable, water emulsifiable LSC can safely be disposed of as non-hazardous.

Do not dispose of any chemical by evaporation.

Also remember: If a

Other Substitutes. In a landmark study, the Division of Environmental Health and Safety

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process is connected to a water supply, do not connect it to a sewer or to contaminated or toxic liquids unless an antisiphon or backflow device is included. Please do not remove installed devices. This protects your drinking water.

of the University of Illinois at Urbana-Champaign explored laboratory waste minimization opportunities. (Ashbrook, Peter C., Cynthia Klein-Banay and Chuck Maier, *Determination, Implementation and Evaluation of Laboratory Waste Minimization Opportunities*, 1992.) The following table includes some common chemical substitutes from that study.

Hazardous Chemical	Safer Substitute	Used For
Acetamide	Stearic Acid	Freezing point depression
Benzene	Xylene or hexane	Many solvent uses
Benzoyl Peroxide	Lauryl Peroxide	Some polymer catalysis
Carbon Tetrachloride	Cyclohexane	Qualitative test for halides
Formaldehyde (Formalin)	Ethanol	Specimen storage
Halogenated Solvents	Non-halogenated solvents	Some extractions and other solvent uses
Sodium Dichromate	Sodium Hypochlorite	Some oxidation reactions
Sulfide ion	Hydroxide ion	Qualitative test for heavy metals
Toluene-based Scintillation Cocktail	Non-ignitable Scintillation Cocktail	Studies using radioactive materials

Search for a safer substitute. Let us know if you find ones not mentioned here.

We've learned much about toxicity in recent years. Try a safer substitute in methods that traditionally use toxic chemicals.

Stop Using Chromic Acid Solution. Chromic acid solution is a mixture of concentrated sulfuric acid and potassium dichromate, Chromerge® (chromic acid), or chromium anhydride (chromium trioxide). It is used to clean laboratory glassware because it oxidizes most residues and eats away a very thin layer of the glass surface, leaving a new, clean surface.

Chromic acid solution is a dangerous chemical. It is a strong corrosive. It is a strong oxidizer that has been known to react violently and explode when combined with oxidizable materials. It contains chromium (VI) (as chromic or dichromic acid), which is a known human carcinogen. Chromium is toxic in other ways to humans, flora and fauna. These properties make it extremely difficult to handle safely.

There are many commercially available alternatives for chromic acid solutions. The Department of Environmental Safety strongly encourages you to stop using chromic acid solutions unless you have tried the alternatives below and found them to be unsatisfactory. They are listed in groups of increasing hazard. This information is derived from the University of Illinois study.

Nonhazardous cleaning solutions (safest; try these first)

- ! Ultrasonic baths (these work well for many labs);
- ! Alconox or similar detergents;
- ! Pierce RBS-35 or similar detergents; and
- ! Biodegradable surfactants.

Substitution with a safer chemical is one of the best ways to prevent pollution.

Substitution isn't always

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ideal. Some procedures don't work as well. Some substitutes aren't as safe as you'd like. Substitution often requires successive trials and evaluations.

Strong corrosive solutions (hazardous due their corrosivity)

- ! Potassium hydroxide/ethanol solutions (also flammable); and
- ! Dilute hydrochloric acid.

Strong oxidizing acid solutions not containing chromium or other toxic metals (very hazardous; least desirable alternative). Other solutions of strongly oxidizing acids work in the same way as chromic acid solution. Potassium permanganate/sulfuric acid baths are generally not recommended: they are very dangerous and potentially explosive if made incorrectly.

- ! Potassium persulfate/sulfuric acid (sold commercially as No-Chromix®); and
- ! Aqua regia (mixture of hydrochloric and nitric acids).

Avoid Mercury and Its Compounds. Like chromium, mercury is a toxic metal that cannot be neutralized (as corrosives can) or destroyed (as organics can). As a result, mercury is very difficult to safely dispose of.

Chromic acid solution is a strongly oxidizing corrosive that contains a carcinogen.

Mercury and its compounds are used widely in laboratories. Mercury waste from broken thermometers and manometers is far too common at the University of Maryland. Although free-flowing metallic mercury can be recycled commercially for reuse, mercury contaminated thermometers and spill cleanup supplies are expensive wastes.

Anyone who has broken a mercury thermometer or spilled free-flowing mercury knows how difficult and time consuming it can be to clean up the residue. In the extreme case, residual mercury from a spill or careless handling can pose a chronic health risk to laboratory personnel because the mercury volatilizes and creates contaminated indoor air.

Stop using chromic acid solution unless you have tried the alternatives and found them to be unsatisfactory.

To prevent these problems, the Department of Environmental Safety strongly recommends that you use alternatives to mercury thermometers. These include alcohol (red liquid) thermometers, thermocouples and other electronic temperature devices.

Thermocouples are preferred for monitoring the temperature of a water bath, where glass thermometers are prone to breakage. If alcohol thermometers and thermocouples are unsatisfactory, we recommend using Teflon® coated thermometers that will contain the mercury in the event that the capillary is broken.

Due to their toxicity, mercury compounds and solutions containing mercury must be carefully stored and used. Laboratories are encouraged to reduce the amount of mercury they use and mercury-containing wastes they generate. Several alternatives exist:

- ! If a mercury compound is specified for a procedure, first determine if a less toxic substitute can be used (for example, in most cases copper sulfate can be substituted as the catalyst in Kjeldahl analyses with no loss in total organic nitrogen recovery);
- ! Reduce the scale of the process to reduce the amount of mercury used and disposed of;
- ! Minimize the volume of waste generated by including precipitation or other treatment methods as the last step; and
- ! Only buy as much mercury and mercury compounds as you will use in the immediate future.

Environmentally Sound Recycling

Recycling is the processing of waste so that it can be used again. Recycling should be done in a way that does not harm the environment. For example, distillation of waste organic

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solvents requires containment to prevent spills and leaks. Controls may be necessary to minimize air emissions and prevent exposure to personnel. Transport and handling risks are minimized when recycling occurs as part of the process (in-process recycling) or near to the point of waste generation (in the lab or building).

Photography laboratories have recovered silver from their wastewater for many years. Many systems exist, including in-lab electrophoretic units that are maintained by commercial services.

At the University of Maryland, the cost and time spent on the cleanup and disposal of mercury spills is disproportionately high.

Distill Waste Organic Solvents

In-laboratory, end-of-experiment distillation is a useful way to recycle waste organic solvents. Some laboratories recover xylene for reuse in tissue preparation; many other histology laboratories have successfully recycled their solvents. Recovered acetone and ethanol can be used for rinsing glassware, where technical grade quality solvents are satisfactory. The University of Illinois study and other laboratories have found that many other wastestreams could be successfully recycled, including methanol/laser dye mixtures and acetonitrile waste from HPLC analysis. *However, if such distillation is performed separately from an experiment, it is considered hazardous waste treatment, which is subject to stringent regulatory requirements.* Therefore, call the Department of Environmental Safety if you would like to explore solvent distillation—we'll help you get started.

In many labs, most mercury thermometers can be replaced with red liquid thermometers.

Commercial Recycling of Chemicals

The University of Maryland actively recycles a number of waste streams. For example, the Motor Pool recycles used motor oil; Shuttle Bus recycles used vehicle batteries; Campus Photo recovers silver from their processing waste; a number of operations on campus recycle parts degreasing solvents; Dining Services recycles freon; and the campus recycles fluorescent and other mercury-containing bulbs. Let us know if you have other ideas for recycling.

REDUCE ENVIRONMENTAL RISKS

After you've tried the above pollution prevention and waste minimization methods, there are many other things you can do to reduce environmental risks. Wastes that are neutralized, treated and/or managed at the source are not subject to accidents and releases that can occur during transportation and handling. The Department of Environmental Safety encourages In-Lab Chemical Management, such as neutralization of acids and chemical treatment of toxic chemicals as the final step of an experiment.

See the *University of Maryland Emergency Response Guide* for details on mercury spill cleanups.

The majority of non-solvent hazardous chemical waste disposed of by Environmental Safety is incinerated. Incinerators reduce the environmental risks of hazardous waste by destroying more than 99.99% of its organic constituents. Air pollution control equipment is used to further reduce emissions.

Neutralize Waste Acids and Bases

The Department of Environmental Safety strongly encourages laboratories to neutralize their uncontaminated waste acids and bases as a final step of an experiment. After neutralization, these wastes can be safely and inexpensively disposed of. Waste acids are very difficult to transport and handle. In-laboratory neutralization can be done safely and is very efficient. *However, if such neutralization is performed separately from an experiment, it is considered hazardous waste treatment, which is subject to stringent regulatory requirements.*

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Contact the Department of Environmental Safety for neutralization procedures.

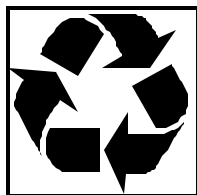
Chemically Treat Laboratory Wastes

The Department of Environmental Safety encourages you to chemically treat certain chemical wastes in your laboratory by making treatment the last step of your experiment. In-lab chemical treatment reduces transport and handling risks, and reduces the cost of collecting and storing chemical waste. If you routinely generate wastes that can be treated, include waste treatment as the final step in your procedures. *However, if such chemical treatment is performed separately from an experiment, it is considered hazardous waste treatment, which is subject to stringent regulatory requirements.*

Because waste organic solvents is such a large wastestream in many operations, distillation and reuse has great potential for preventing pollution.

The Department of Environmental Safety can suggest methods for deactivation, oxidation using bleach, precipitation and reduction to yield a less toxic waste. Some of the chemical treatment procedures available for use include:

- ! Acrylamide solutions (polymerization)
- ! Chemical carcinogens and mutagens
- ! Cyanide salts (oxidation with bleach)
- ! Ethidium bromide solutions (oxidation with bleach)
- ! Neutralize Acid 6: Chromic acid cleaning solutions (reduction and neutralization of Cr(VI)) and COD waste
- ! Osmium tetroxide (conversion to less volatile form)



Reduce, reuse, recycle!

Many other in-lab chemical treatment procedures can be found in the *Hazardous Laboratory Chemicals Disposal Guide* by Margaret A. Armour, CRC Press, 1991 and *Destruction of Hazardous Chemicals in the Laboratory* by George Lunn and Eric B. Sansone, Wiley-Interscience, 1990.

MANAGE WASTE EFFICIENTLY

In most cases, waste can be minimized, but not eliminated. As mentioned at the beginning of this *Guide*, waste is a natural product of research, teaching, testing, and many other operations. It is prudent to manage all wastes as efficiently as possible. Resources saved from efficient waste management can be used to improve the University's teaching, research and public service programs. Resources saved can be reallocated to other environmental protection projects.

For those wastes that cannot be prevented or further minimized, incineration and fuel blending are environmentally sound chemical disposal methods.

The management of chemical waste is most efficient when personnel keep waste types separate, prudently use the sanitary sewer and normal trash, and help us collect waste efficiently. For example, the Department of Environmental Safety collects and handles waste organic solvents in carboys because it is safer and more efficient than collecting such waste in many smaller bottles.

Keep Waste Types Separate

Do not mix different types of wastes except organic solvents that are collected in carboys, as described in the *Hazardous and Regulated Waste Procedures Manual (1997)*. When hazardous and nonhazardous wastes are mixed, the mixture becomes hazardous and the entire volume needs special disposal procedures. When wastes of different characteristics and compositions are mixed, treatment and disposal becomes much more difficult. For example, organic chemicals can be incinerated, but mercury waste that has been mixed with organic chemicals cannot be incinerated safely. Most importantly:

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Take responsibility for the waste you generate by neutralizing acids and chemically treating other wastes. Contact the Department of Environmental Safety to find out how.

- ! Do not place hazardous waste in the normal trash. Contact the Department of Environmental Safety for guidance on wastes that can safely be disposed of in the normal trash.
- ! Do not place normal trash (or wastes that can be disposed of in the normal trash or sanitary sewer) in containers of laboratory chemicals or chemical wastes.
- ! Segregate non-halogenated solvents suitable for fuel blending from halogenated solvents that must be incinerated, with no energy recovery. Contact the Department of Environmental Safety for help with organic solvents and their appropriate classifications.

Safely Use the Sanitary Sewer and Normal Trash

There are many laboratory wastes that can safely be disposed of in the sanitary sewer or in the normal trash. Proper use of these methods prevents unnecessary handling of these wastes. Contact the Department of Environmental Safety for specific procedures for using the sanitary sewer and the normal trash.

Minimize Chemically Contaminated Labware

One growing wastestream is chemically contaminated labware. There are several ways to reduce the volume of contaminated labware. First, discard only wastes known to be chemically contaminated as hazardous wastes. If your gloves and benchtop covers were not contaminated, dispose of them as normal trash. For contaminated labware, try to decontaminate it. Contact the Department of Environmental Safety for guidance.

Is Your Operation A Green Operation?

A Green Operation is one that understands its impact on the environment and tries to minimize it. Since operations differ, there is no one standard for a Green Operation. The following actions, however, are ways of pursuing sound environmental practices. A Green Operation will:

- ! Train new personnel in chemical and environmental safety, including methods of pollution prevention and waste minimization used in the operation;
- ! Assess air emissions, wastewater discharges and waste generation to understand how your operations impact the environment;
- ! Buy only the chemicals and amounts needed;
- ! Use redistributed surplus chemicals whenever possible;
- ! Review chemical inventories and routinely post usable surplus on the **Chemical Exchange Page**, thereby making chemicals available to other users;
- ! Review the chemicals in use to understand their hazards (e.g., reading Material Safety Data Sheets) and search for safer substitutes;
- ! Keep caps on carboys and other containers of chemicals;
- ! Prepare for leaks and spills by using secondary containment and by maintaining a spill kit available through General Supply;
- ! Take responsibility for waste disposal by neutralizing acids and treating other chemicals as a final step of an experiment; and
- ! Remind colleagues and new personnel to keep waste types separate, and devise a system of separate waste collection that works for your operation.

AN ENVIRONMENTAL ETHIC

Individuals who value the environment bring a special zeal to pollution prevention. On campus, an environmental ethic means taking responsibility for the byproducts of your operations and the waste that is generated. Because the user is most familiar with their work

Keeping wastes

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separate maximizes disposal options and keeps disposal costs down.

and the materials they use, they are the best source of new ideas to prevent pollution and minimize waste. We are eager to work with you in finding new solutions and implementing the ones described in this *Guide*.

Also keep radioactive, biohazardous and chemical waste as separate as possible.

Contact the Department of Environmental Safety for guidelines on normal trash and sanitary sewer disposal.

What is a Green Operation? There's no one answer. Let us

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know what you think
defines a Green
Operation.

Call the Department of
Environmental Safety if
you have pollution
prevention ideas. We
can help implement
them. We will share
successful solutions
with others.

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