

Hazardous Material Recycling and Disposal Information and Guidelines

Introduction

The generation of unwanted hazardous materials and waste products is an inevitable consequence of chemistry research and shop activities. Strict labeling, segregation, and packaging requirements must be followed to ensure that unwanted hazardous materials are handled safely and recycled or disposed of in accordance with all applicable Federal, State, and local regulations as well as in an environmentally sound manner.

Recycling of unwanted chemicals should always be the first consideration when starting the process of chemical removal. The College's Chemical Reuse Facility is the repository of high quality chemicals that are free to the College of Chemistry researchers. Any chemical reagents donated to ReUse are screened for quality and potential reusability. All reagents accepted into ReUse have no disposal charges associated with them. All reagents not meeting acceptance standards are directed for disposal to the HWP for profiling by college EH&S staff and subsequent off-site shipment.

The campus EH&S department manages the Hazardous Waste Program (HWP) online tracking software where researchers are initially given hazardous waste generator training, and can subsequently create & print hazardous waste labels. The program can be accessed off the College of Chemistry's home page or campus EH&S's homepage. Any person generating hazardous waste on campus is required by State and Federal Law to complete the HWP generator training first.

The following guidelines have been prepared to assist researchers and college staff in meeting their hazardous material recycling and disposal responsibilities.

Redistribution of Commercial Chemicals

The Chemical Reuse Facility

To donate commercial chemicals that are both in good condition and in their original containers with intact labeling, contact the Facility's specialist at 2-2630 or send an email notice to emery@cchem.berkeley.edu with pertinent details about your chemical donation (approx. # of bottles, current storage location, appropriate chart string for the job, etc.)

. Chemicals free of contamination that are not already overstocked for which there is suspected demand will be accepted. Jug solvents, mineral acids, explosives, gases and chemicals in pressure-containers cannot be accepted. Chemical reagents that don't meet these criteria will be processed for disposal through HWP.

It should be noted that campus EH&S assesses a "flat" per item charge for any chemical disposed of, whether that bottle is a gallon big or 100mg small. The current "per bottle" handling charge is \$5.00 (but this can change without notice), and is detailed in Table 2 below. This encourages generators to consolidate compatible materials as much as feasibly & safely possible before tendering them for off-site shipment.

Disposal of Routinely Generated Hazardous Waste

You can find the "Hazardous Waste Program" (HWP) online at <http://ehs.berkeley.edu/hwp.html>. This online program is where each researcher can create waste labels, request pickups of waste, and order new supplies. Everyone in the lab is required to take the "Hazardous Waste Program" (HWP) training, which automatically displays when new students or lab personnel peruse the program for the first time.

Corrosive Acids, Bases, Strong Oxidizer Liquids

These spent liquids should be collected in the same type of container they were delivered in, i.e. glass in most cases. Keep mineral acids segregated from organic acids and keep strong acids segregated from dilute solutions. Keep caustics/bases segregated from acids and other oxidizers. College supplied containment trays are available to assist you with segregation and separation. Call 3-0526 for trays.

Cyanide-containing spent liquids should only be collected in containers that do not exceed 1 liter in volume due to the unique disposal requirements stipulated in the U.C. system-wide hazardous waste contract. If the campus Hazardous Material Facility (HMF) receives cyanide-containing liquids in excess of 1 liter, they will have to split the item down to appropriately-sized containers and charge the group accordingly for this additional service.

Other Spent Liquids: Solvents, Aqueous Solutions, Oils, and Mixtures Thereof

Spent solvents, aqueous solutions, and oils are transported to the campus Hazardous Materials Facility (HMF) for further characterization and possible bulking into drums before transport to off-site incineration or fuel-blending facilities. The profile types that fall under this category are BtuH, BtuL, and BSI.

- BtuH = Btu-High
- BtuL = Btu-Low
- BSI = Bulk Solvents for Incineration

Solvent and/or aqueous mixtures that do not meet bulking criteria are “lab-packed” (as is) into open-top drums and cushioned/separated with vermiculite before being sent off-site for incineration. The profile types that fall under this category are LPNR and LPR.

- LPNR = Lab Pack, Non-Reactive
- LPR = Lab Pack, Reactive

All spent liquids in this category should be containerized and segregated according to Table 1 in order to minimize the disposal cost to the group. The table is written in the context of what you can put into a solvent waste jug and maintain the minimum fee for disposal.

Table 1 is to be used as a guide for the collection and segregation of spent liquids.

Table 1: Bulk Solvent Profiles

	BtuH	BtuL	BSI
Tier 1	Water <=20% Halogen <=5% Water + Halogen <=20%	Water <=20% Halogen <=20% Water + Halogen <=20%	Water <=60% Halogen <=80% Water + Halogen <=80%
Tier 2	No RCRA Metals No elemental Bromine (or) Bromine Solutions No Cyanides or Sulfides No Mercaptans or Thiols No Dioxins or Pesticides	No RCRA Metals No elemental Bromine (or) Bromine Solutions No Cyanides or Sulfides No Mercaptans or Thiols No Dioxins or Pesticides	No RCRA Metals No elemental Bromine (or) Bromine Solutions No Cyanides or Sulfides No Mercaptans or Thiols No Dioxins or Pesticides

Tier 3	No sludge >1/2"	No sludge >1/2"	No sludge >1/2"
	No dark and opaque bottles pH = 4 to 10	No dark and opaque bottles pH = 4 to 10	No dark and opaque bottles pH = 4 to 10

Tier 1 describes the allowable aqueous/halogenation cutoffs for each particular waste stream. Any of the three categories (BtuH, BtuL, or BSI) is suitable for disposal cost minimization. The cost difference between the three profile types is usually slight (and currently is nonexistent) is listed in Table 2. Any solvent/aqueous mixtures not meeting these criteria become designated as the more expensive LPNR or LPR profiles.

Tier 2 constituents are listed next in the line. If any of the listed constituents are in the waste mixture (even in trace amounts, in the case of RCRA metals), it will not meet the bulk rate profile specifications. Therefore, these constituents should not be combined with routine spent solvent materials whenever possible. Care should be taken to keep the volume of Tier 2 materials to a minimum.

Tier 3 conditions must be met in order to qualify for bulking into drums at HMF. Any dark or opaque bottles must have listed constituents that would reasonably give rise to the dark or opaque quality. Depending on the darkness and/or opacity the waste may be bulked or designated under a Lab Pack profile. It is the final decision of the HMF staff as to whether the specific darkness or opaqueness moves the container out of the bulk rate and into the lab-pack rate. Sludge of greater than 1/2 inch of would eliminate the container from the bulk rate, as well as pH's listed outside the range. Proper pH testing is imperative; multi-layered solvent mixtures must be sampled appropriately in order to reach valid pH levels representative of all observable layers. (This step alone, when poorly performed, is often a cause of solvent mixtures getting re-routed to Lab Pack profiles).

HazCat ("Hazard Categorization") refers to field-testing that must be conducted to characterize the basic hazards of liquids that have no definitive labeling or proper identification. The HazCat charge is in addition to the per item fee & per pound fee if its use is necessitated to characterize an Unknown mixture.

Table 2: Waste Chemical Costs	
per Item (bottle) charge	\$5.00/each

BtuH	\$1.03/lb
BtuL	\$1.03/lb
BSI	\$1.03/lb

Lab Pack Non-Reactive	\$5.93/lb
Lab Pack Reactive	\$39.92/lb
Elemental Bromine and Solutions	\$39.92/lb
HAZCAT Charge	\$42.00/item

Disclaimer: Prices subject to change at any time. Use for comparative purposes only.

A current listing of Recharge Rates can be found at: <http://controller.berkeley.edu/recharge/CurrentRates/ehs.htm>

Used Laser Dye

Used methanol laser dye is also collected from the labs in gallon jugs and can usually meet the bulk solvent profile if it contains a low percentage of DMSO. (Unfortunately, DMSO-based laser dyes must be handled as a Lab Pack item rather than the bulk solvent profile.) Collect DMSO dyes in properly labeled gallon jugs and dispose through the Campus HWP program.

Products of Experiments

Liquid and solid products generated from experiments that do not fit the above criteria still must be containerized, labeled and handled according to Federal and State Law. The EHS&S program can help you identify the proper procedure for handling your research products. Call us at 2-2630 for assistance.

Chemically Contaminated Laboratory Debris

Laboratory debris such as used paper towels, pipettes, gloves, glassware, and open containers that are contaminated with trace amounts of chemical residue, cannot be disposed of in the municipal trash and must be disposed of in the blue 15 gallon drums labeled with a "Hazardous Waste Label" and a yellow "Chemically Contaminated Material Only" sticker. These buckets are emptied by Campus EH&S. Most of the college is on a routine schedule. If you need to schedule a Contaminated Lab Debris pickup call 3-0526. Keep the top on the blue drums when not adding waste.

Solvents, vials or containers of liquids, sharps or bulk quantities of

chemicals are **NOT** to be placed in these pails. Small EMPTY vials or containers can be placed in the blue drums if there are only trace amounts of chemical residue. Notify the EHS&S program at 2-2630 to arrange for a chemical lab pack of your unwanted bulk chemicals. Your research director will be billed by the pound for Contaminated Laboratory Debris, so do not put uncontaminated material in these special drums.

Empty Glass and Metal Chemical Containers

Empty 4-liter glass bottles and steel or aluminum ether cans can be disposed of by placing them in the specially labeled bins located in corridors throughout the College. Note that only completely empty containers that are totally free of chemical residue can be disposed of in this manner. The legal criteria for what constitutes an “empty” container are very strict and are defined in the attached Glass Solvent Bottle Disposal Guidelines (see Appendix 6b). All generators of disposable glass solvent bottles should review these guidelines to insure that empty containers are managed properly. Glass that is determined to be not legally empty must be disposed of as Contaminated Laboratory Debris as described above.

Drain Disposal Guidelines

Federal, State, and local laws and regulations control the disposal of chemicals into any sewer system. As written, these laws prohibit any drain disposal of *hazardous wastes* and severely limit the allowable wastewater concentration of a number of specific substances. The range of substances that can be considered to be hazardous waste is enormous. Indeed, almost any chemical substance is unacceptable for drain disposal if it is disposed of in large quantities or in high concentrations.

Federal and California hazardous waste laws do permit laboratories to drain dispose of small amounts of some chemicals in quantities that do not pose a hazard to human health or the environment. In order to help researchers determine which chemicals and quantities are acceptable for drain disposal, UC Berkeley has developed guidelines that apply to drain disposal of chemicals from laboratory sinks on campus. In general, laboratory sink disposal of chemicals is limited to the occasional disposal of small amounts of chemicals of high water solubility. All researchers should review the “Interim Guidelines for Drain Disposal of Chemicals” (see Appendix 6a) very carefully prior to discharging any chemical in

laboratory sinks.

Disposal of Special Hazardous Materials

Full Height Gas Cylinders

Full height gas cylinders, whether empty or partially full, should be taken to the College Receiving Dock (B84 Hildebrand) and checked into the cylinder cage for return to the vendor. Helium tanks are the exception. These should be returned to the College's Liquid Air Plant in Giauque Hall.

Small Gas Cylinders

It is very costly to send small gas cylinders (less than 8" in diameter and 24" in height), lecture bottles and other assorted pressure containers to a disposal vendor. Available alternatives include fully-utilizing a cylinder's contents within your lab or passing the partially full cylinder to another researcher who will. Once a cylinder is empty simply call the EHS&S program at 3-0526 to arrange for pick up. If a cylinder contains a reactive gas or liquid, it can be quenched and purged before the valve is removed. Call the tech support number of the original seller (Aldrich, Matheson, etc.) and ask that quenching/purging instructions be sent to you by fax. If a gas cylinder must be sent for disposal, notify the College EHS&S program at 3-0526. Lecture bottle size cylinders will be gathered and submitted to the campus's contracted disposal company once or twice per year, at a charge of \$200-\$800 per cylinder, depending on the type of gas. A cylinder containing an UNKNOWN gas will cost \$1500-\$5000 and the procedure may take as long as a year. If the cylinder is inoperable or the valve is damaged the costs can exceed \$20,000. Be sure to evaluate your unwanted cylinders carefully! Problem cylinders need to be brought to immediate attention of the P.I. and EHS&S.

AT LEAST TWICE PER YEAR, CHECK TO SEE THAT YOUR GROUP'S STORED GASES HAVE SECURE, MULTIPLE LABELS. Also make sure that all gas cylinders are entered into your 4D chemical inventory.

Batteries

Alkaline, zinc-carbon dry cell, sealed small lead acid batteries and lithium batteries are considered Universal Wastes and must be disposed of accordingly. There are two areas where universal waste batteries are collected: 791 Tan Hall (chem stores) and 317 Lewis Hall. Wet-cell batteries are disposed of similarly to Lab-Packed chemicals. Contact 2-2630 to arrange for pick up of wet-cell batteries. Contact the College EHS&S program if you have batteries that don't meet the above descriptions. At no time should ANY battery be thrown into the common trash.

Controlled substances

Detailed instruction on managing and disposing of controlled substances is provided in a Campus EH&S Help Sheet and can be found on their website or see Appendix 6e in this section of the College of Chemistry Health and Safety Manual.

Potential explosives

Contact the College EHS&S program at 3-0648 for guidance.

Medical waste/Bio-hazardous waste

Detailed instruction on managing and disposing of medical waste is provided in a Campus EH&S Help Sheet (see Appendix 6c in this section of the College of Chemistry Health and Safety Manual).

Mercury

Mercury containing thermometers and other analytical devices need to be disposed of through the College EHS&S program. If you have a very small mercury spill you can clean it up yourself.

Contact the College Health and Safety team at 3-0526 or 3-0648 for assistance in disposing of spilled mercury and contaminated debris. Any other mercury spill should be cleaned up by trained, qualified personnel. If a spill occurs, evacuate the room, control access and call 2-9090 for help.

Radioactive Waste

Radioactive waste must be handled and disposed of in strict compliance with the UC Berkeley Radiation Safety Manual. All radioactive waste (radwaste) must be kept bagged in properly marked and shielded waste containers. Solid wastes cannot contain any freestanding liquid. Liquid radwaste must be kept in double containment. Radwaste must be kept segregated by isotope. Do not intentionally mix chemical wastes and radwaste. Mixed wastes should be avoided whenever possible.

Radwaste pick-up and disposal is managed by the UC Berkeley Office of Environment, Health and Safety (contact Pat Goff at 2-1925 for more information).

Sharps – Chemically Contaminated Sharps

All chemically contaminated needles and razor blades need to be disposed of in the red sharps containers (available from the storeroom). Make sure to print out a label from the HWP program and deface the bio-hazard/etiological agent symbol. Unused sharps should also be placed in these containers for disposal. When the container is full tape the top of the container so that the lid stays closed in transit and request a pickup through the HWP program.

Sharps – Medical Waste, Bio-hazardous

Sharps that are contaminated with bio-hazardous materials must be handled according to the medical waste disposal guidelines (see Appendices 6c and 6d in this section of the College of Chemistry Health and Safety Manual). Red containers with appropriate labeling are available through chemstores.

Silica Gel

Used silica gel and other chromatographic supports should be deposited into the appropriately labeled blue 5-gallon pails within the plastic liner that is provided with each blue pail. Contact the College EHS&S team at (3-0526) for disposal.

Unknown liquid or solid chemicals

Contact the College EHS&S team at 3-0648. Unknown materials cannot be sent for disposal until they are characterized. Identification of unknown material hazards is costly; so make a strict habit of keeping ALL chemical containers properly labeled.

Refer to Table 2 for HAZCAT testing fee charges. These charges are per item.