Chemical Waste Handling Guide

For the College of Arts and Science
At Eastern Kentucky University

Feb 2007

Chemical waste handling

Proper handling of chemical waste is important because it is a standard safety protocol expected of all disciplines in the College of Arts and Science. Also, under current regulations mishandling of chemical substances can result in legal action and heavy fines. Some chemicals and items that one can casually discard at ones' home are considered hazardous chemicals here at the University, due to state and federal regulations. Each employee must strive to follow the state and federal guidelines for disposal of chemical waste. Since these regulations are long and confusing, this document has been compiled to explain how operations concerning chemical waste will be handled here at Eastern Kentucky University. The latter portion of this document is a simplified discussion of the regulations regarding chemical waste intended to educate and enlighten personnel regarding the federal and the state requirements.

Below is a short guide which lists the highlights of handling chemical waste at Eastern Kentucky University

1. Limit the amount of chemicals from the start.
    A. Order smallest quantity needed for project
    B. Do not accept chemical donations

2. Choose an appropriate container
    A. Assure container is compatible material for the chemical waste being collected for disposal
    B. Select the appropriate size container

3. Adhere to labeling and handling rules for containers concerning chemical waste collection in work area.
    A. Clearly mark the words " Hazardous Waste" on each container
    B. Ensure "accumulation start date" is marked on each container
    C. Make sure complete chemical name is listed on each container
    D. Keep each container closed except when adding more waste to the container
    E. Follow protocol when using recycled containers for waste collection

4. Adhere to federal regulations for "satellite waste accumulation"
    A. When full the waste container must be sent to main accumulation site within three days.
    B. Maximum time for a container in a satellite area is one semester.
    C. If a process for generating chemical waste stops, then the waste container must immediately be sent to main accumulation site.

5. Practice good handling techniques of chemical mixtures
    A. Do not make mixtures if avoidable
    B. If a mixture of chemicals is an unavoidable result of a particular task then list the percentage of each component.

6. Segregate the types of chemicals
    A. Ignitable/ flammable
    B. Corrosive
    C. Oxidizer
    D. Non-chlorinated solvents
    E. Chlorinated solvents
    F. Toxin or irritant

7. Process the chemical waste to be picked up for disposal
    A. Place a completed hazardous waste form on each container
    B. Inspect condition container and seal/close each container
    C. Contact personnel in charge of main waste accumulation site by e-mail.

8. Drain disposal of chemicals

    A. Hazardous chemicals must not be poured in sewer system
    B. An appendix listing minor amounts safe for drain disposal is being established through the College Safety committee.

1. Limit amount of chemicals at Eastern Kentucky University

A. Order smallest quantity of chemical from the start.

If ordering chemicals, do not order strictly by a cost per unit philosophy. It is recognized that many times, a larger container may seem like the better buy. For example, if you have need of 20 grams of a chemical, you may find a 10 gram bottle costs $15 and $28 will buy 100 g bottle. At first glance the 100 grams may seem like the bargain. But if the 80 grams has no direct use, it will usually become chemical waste within a few years. Depending on the particular chemical, the waste disposal can be quite expensive. Therefore, in the above example, it is best to buy two bottles of ten grams of the chemicals, to prevent future unwanted cost.

In addition, scale down your experiment, (especially in research) until a larger need is established for the chemical. Most procedures can be modified so smaller amounts of chemicals can be used.

The cost saving one tries by ordering large quantities of chemicals with the hope of a future undefined use leads to the excess unused chemicals. Such materials will usually become chemical waste and ultimately cost EKU more money. Also, the excess chemicals require proper tracking. This means individuals must maintain accurate records and logs of this chemical until the chemical is no longer at the work site. Failure to keep accurate records is a violation of current federal and state regulations. Such violations can result in fines. To avoid such a situation, University personnel should design projects and order quantities which can be consumed within one year. This will keep individual laboratory chemical stock down to a very manageable level for record keeping. The College of Arts and Science has a Chemical Storage Facility to maintain a larger supply of any chemical which proves to warrant having an in-house stock.

B. Do not accept chemical donations.

Donations of chemicals are never a bargain. When donations have been accepted in the past, most of the chemicals became chemical waste a few years later. Numerous times in the past EKU ended up paying for waste disposal of such donated chemicals. Even if there is a chemical that might be used at EKU, the transportation of the chemicals is dangerous and unlawful in most situations. Without the proper licenses chemicals can not be shipped. The United States postal service does not allow the mailing of chemicals. Chemicals can not be legally transported in personal vehicles. In the event of an accident during transportation of chemicals in private vehicles on public highways one can find oneself in an unnecessary legal liability situation, which may not be covered by the University. Therefore, to legally transport the donated chemicals, arrangements would have to be made for pick up or shipment of the chemical to EKU by a contractor.

This usually exceeds any saving that might be observed from a donation. Therefore, it is the policy at EKU not to accept chemical donations.

2. Choosing the container for collecting waste

A. Compatibility

It is important to use the proper container when collecting hazardous chemicals. Make sure the container is compatible with the chemical you wish to collect. An example of an incompatible container is glass for solutions of hydrofluoric acid or extremely strong alkaline chemicals. In this particular situation the chemical will actually digest the glass container. Given time the container will crack or break while just setting in storage. In general, choose a container that is in good shape and can allow the chemical waste to be safely stored (**for six months to a year**) and ensure no problems during transportation. Check the container for cracks and flaws that jeopardize the integrity of the container. All containers must have a screw top cap or be securely sealed in such a manner to prevent seepage even if the container tipped over during transport. Any plastic container should be relatively new. Older plastic bottles lose elastic properties and become very brittle. To test plastic containers gently squeeze the empty bottle. If the container cracks during this testing process do not use and dispose of the container in a trash can.

1. Never use plastic milk jugs. Integrity of the seal is not sufficient.

2. Containers and bottles can not be sealed just using a cork. Integrity of the seal is not sufficient.

3. Containers must not have visible flaws. Containers must not have cracks or visible weak spots.

4. Metal safety cans should be avoided for many chemical wastes due to the corrosive nature of many solvents and liquids. In addition, pouring into and from these safety cans is a difficult skill to master and usually results in spills.

For simple waste (i.e. materials that do not have corrosive, reactive or volatile properties) containers can be purchased from local retailers (examples would be Lowes, Walmart) If your waste has dangerous properties specialized waste containers can be purchased from vendor such as Fisher Scientific, Sigma-Aldrich, Lab Safety supplies, etc. If you need assistance locating companies for ordering appropriate containers contact the Chemical Storage Manager or your safety committee member.

B. Size of container

Make sure containers are as small as possible. Waste disposal companies can charge by the size of the container. Therefore 100 ml of benzene in a four liter bottle can be charged as four liters of benzene. This is an extreme example, but the point is to emphasize the importance of correct container selection. Larger containers cause unnecessary expense. In addition, larger waste containers can lead to extra items being dumped in by other users or colleagues. Therefore, estimate the amount of waste to be generated prior to an experiment or task and put out an appropriate size container.

Even if it takes multiple containers to collect waste during an exercise, be selective about the size of that waste container. The container should be kept to a size so that once the experiment/task is over the waste can be sent off to the main accumulation site. Try to avoid or at least minimize putting out large containers which remain unused or idle for weeks. This usually leads to problem. At maximum the time span a waste container should be in a work area is one semester. A more frequent change out of chemical waste containers is recommended.

3. Labeling of containers

For all chemical waste containers you **must do** the following.

A) Make sure all waste containers are **clearly labeled** with the exact wording **"Hazardous Waste"** (this is a regulation requirement)**.**

B) Put a start **accumulation date** on the container.

C) Put the complete chemical name of the compound on the container. Do not use abbreviations or codes or just chemical formulas.

D) Keep the container closed except when adding more waste to the container.

E) Follow proper protocol when using recycled containers

1) The container should be thoroughly cleaned/rinsed to remove any residual chemicals.

2) The compatibility of the chemical with the container must meet the guidelines listed in the previous compatibility section.

3) The old label must be totally removed or thoroughly marked out /obliterated (including inappropriate hazard and/or health warnings)

4) Containers with raised lettering (such as gasoline cans) shall not be used.

5) Simply taping over or masking the old label is **not** allowed.

4. Satellite accumulation areas

Many laboratories and work areas generate hazardous waste on daily or weekly basis during normal operations at the University. Such accumulation is allowed per the federal (CFR 262.34) or state guidelines as long as certain rules are followed. These areas are referred to as "satellite accumulation sites". For the University the rules listed below apply to for such areas.

A) All waste bottles **once full need to be turned in** to the main accumulation site (the chemical storage facility) **within 3 days**.

B) **The maximum amount of time a waste bottle should remain in a satellite area should be one semester.** The federal regulation allows one year for "satellite accumulation points". But this regulation is designed for industry use. The University is set up to operate by semester, so it is logical for the waste disposal to operate in the same manner. This will help to minimize confusion of exact content in a waste container as many areas are shared working areas. If waste containers are left in areas for many semesters then unknown waste gets dumped into containers and ownership of the container becomes fuzzy. In addition, it is just good housekeeping to clear out areas more frequently than once a year.

C) If the process for generating a certain chemical waste stops in any area (example the research project is over) then the waste needs to go directly to the main accumulation area.

Unknowns usually are the result of poor labeling practices. The Chemical Storage Facility (main accumulation site for the college of Arts and Sciences) and/or waste pickup vendors **will not accept unknown chemical waste**. The department in which the chemical resides is responsible for sending the unknown chemical out for analysis. If any container is submitted to the chemical storage facility and is later deemed to be unknown chemical waste the cost of identification could be charged to the originating department.

Research chemicals need to be given special attention. The information needed to properly label research compounds can be difficult to obtain. The main reason is that if the lead researcher retires or graduates (if he/she is a student) there is no one available with the necessary knowledge to definitively identify the material. This leads to unknown hazardous chemical waste. The expense of determining the unknown's chemical

class or identity can be passed down to the department. It is recommended that departments routinely monitor work areas to keep an eye out for unlabelled chemicals. Department policies should be established for final check out of work areas before personnel permanently depart from EKU to minimize unknowns being left behind.

5. Handling Chemical Mixtures

All chemical mixtures should be avoided. Disposal companies charge much more for mixtures. This excess cost is charged sometime even when a complete list of chemicals is attached to a waste bottle. The disposal companies see a severe hazard listed (example an oxidizer) and then classifies the whole bottle as if it were all that chemical. The other scenario that adds cost is that something suspicious is observed. An example would be that the amounts of the separate chemicals listed on the bottle do not add up to the total amount in the bottle. Another problem is that there are multiple layers observed. These problems can end up putting such waste jars in the unknown category and the cost can rises as a result. It is re-emphasized that separate bottles should be used for each chemical waste when ever possible. It is recognized that sometimes at a university mixtures are the result of processes in college teaching and research laboratories. If a mixture is unavoidable the amount and concentration of each component must be listed. If exact amounts of the components are not known, intelligent estimates need to be made about mixtures of the ratio of the various components. Even a statement as simple as "Component A is less than 1% of the total volume" is very helpful to managing the waste.

The main points concerning mixtures are the following two points. First, avoid mixture if at all possible. Second, if mixtures are unavoidable use simple brief words to detail the most accurate information about mixtures.

6.Chemical waste segregation

Chemical waste segregation has several advantages: the prevention of unwanted or potentially dangerous reactions, the protection of personnel, the ease in handling and disposing of waste, the reduction of disposal cost and minimization of liability for the University. When working at the University mixtures are to be avoided. Make sure all personnel understand that **different types of chemical waste categories should never be mixed**, as unwanted and/or violent reactions may occur. The waste containers should be physically separated by sufficient distances. This helps to prevent students, staff and faculty from accidentally pouring waste in the wrong containers and minimizes the unintended mixing of chemicals in the event of an accidental spill.

The minimum categories for segregation are as follows:

- Flammable / Ignitable
- Corrosive
- Oxidizer
- Non-halogenated solvents
- Halogenated solvents
- Toxic or irritants

Note: Additional categories are possible. If you feel a certain chemical and/or group of chemicals is incompatible segregate it.

7.Preparing chemical for waste pickup

Chemical waste will only be picked up if properly packaged and labeled. A suitable container is necessary. The guidelines provided in the previous sections should be helpful. If a chemical seems atypical contact the vendor of the chemical for waste handling instructions or check MSDS sheets. The college safety officer, the chemical storage manager and/ or safety committee members for your department will try to assist you further. If the contractor hired by the university to pick up the chemical waste rejects the container the generating department may be subjected to charges incurred to properly dispose of the container.

A. On each container a copy of the completed hazardous waste pick-up form must be attached. (See the attachment at the end of this document). Also copies of this form can be requested from the "Risk Management Office." The form should be firmly taped to the container, but sometimes the size of the container makes this impractical. The form is designed to include the following minimum information:

    Chemical name (not initials nor abbreviations/ not trade names)
    Amount of material in milliliters and/or grams.
    The accumulation start date.
    Originating person/dept.
    The building the chemical waste was generated in.
    The room the chemical waste was generated in.
    Hazards

B. Inspect the container for flaws since accumulation began. Check for cracks or chips in the seals or caps. Make sure the label has not been made illegible by spillage of the chemical across the label. Additionally, check that no abbreviations of the chemical names are listed on the label. Make sure the proper forms have been filled out, attached to, and/or accompany the container.

C. Once you have the chemical waste properly labeled, contact the Chemical Storage Manager (Larry Miller) to arrange transfer to the main accumulations site (Moore 418) where the waste container will be stored until the next regularly scheduled university wide chemical waste pick-up. If the container is deemed to have problems these must be resolved before the container will be removed for disposal.

8.Drain disposal

A. Hazardous chemicals must not be poured down sinks or drains. Hazardous chemicals are any substance that can cause physical and/or health problems. Any of the previously mentioned categories can not be poured down a drain. In addition, any substance which might initiate a hazardous situation if it reacts with a substance commonly found in sewage systems can not be poured down the drain. Therefore, a substance must be non-hazardous or totally inert to be considered for disposal in this manner. Even after that the substance must be water soluble or it could still cause plumbing problems.

B. The safety committee will be working on an appendix for this document which will allow small quantities (100g per day) of common chemical salts and other minor chemicals to be disposed of down the drain if proper protocols are followed. At this point in time, if there is a particular substance that is a borderline item please contact your safety committee representative, the college chemical safety officer, or the college chemical storage manager for assistance with a determination.

Summary and miscellaneous items

- All containers must be compatible with the specific chemical stored in them.
- Avoid combining chemicals. If you must combine waste be consistent. Waste streams with too many components may be rejected by companies contracted to pick up waste or the company may charge by the most expensive item in the mixture. Therefore mixtures could be returned to department generating waste or charges may be levied on department for fees due to analysis and/or cost of separating mixtures.
- Select a container size that matches the amount of waste.
- Any container may be rejected if too heavy.
- Waste containers must not leak. Containers need an appropriate cap.
- All containers must be identified and labeled with the name of the chemical/chemicals which has been placed in the container. Label with legitimate legible chemical name. **Abbreviations or formulas are not sufficient.**
- Collect halogenated and non-halogenated organic solvents in separate containers
- Separate organic waste from metal-containing and/or inorganic wastes

- Do not mix solids and liquids wastes. Liquids should be strained of all solids (e.g. towels, filters, ph paper, etc.). Care should be taken to prevent every day refuge from being placed in chemical waste containers.
- Separate mercury solutions and mercury compounds from other waste as much as possible.
- Vacuum pump oil and other machine oils must be kept separated.
- Labware and equipment obviously contaminated with acutely hazardous chemicals should be handled as contaminated debris. See chemical hygiene plan for disposal of these materials.
- Separate radioactive waste
- Separate highly toxic chemicals (example cyanides)
- Keep oxidizing chemical waste stored in separate containers
- Separate nonhazardous chemical waste and determine if these can be disposed of through city waste streams.

A VERY SHORT COURSE OF HAZARDOUS WASTE REGULATIONS

The following is a very simplified short version of the federal and state hazardous waste regulations.

First it is important to try to explain what is a "Hazardous Waste" according to the federal and state guidelines. The simple answer is most every solvents, solutions, gases, and solids used in science laboratories maybe considered hazardous waste. The regulations read like a tax code and many interpretations can be applied. But there are some concepts that are clearly understood by most people that read the regulations.

Listed Chemical Waste

First, if the chemical appears on the listed chemical manifest of U. S. RCRA document 40 CFR 261.30-261.33 it is a hazardous waste. No wiggle room in this part of the regulation. If a chemical is on the list it is a hazardous waste and must be treated as such. There are four categories subdivided on this list.

The first is the "F" listed waste. These are chemical waste from nonspecific sources such as solvent, plating solutions and chemical manufacturing processes. There are 28 specific type listed in 40 CFR 261.30-261.37. These waste products are not a problem for the College of Arts and Science here at the University.

The next is referred to as “K” listed waste. This is chemical waste from specific sources from industrial processes which results in unusable waste. The “K” listed waste number over 100 items.

The third category is “U” listed waste. These are items for what ever reason, (back in the seventies) were deem specifically as hazardous. This list is several hundreds of items in length. Some of these items are used at EKU.

The final category if called “P” listed waste. And again EKU has some of these items. These items have been sited as being very hazardous by the regulations. The added twist is that only one kilogram (2.2 lbs) can be disposed of per month. The reasoning is most likely to discourage use of these items. Any use of these items at EKU should be disallowed or used in very minimal amounts.

To summarize this part of the regulation if any of these chemicals are used here at EKU then they are hazardous waste and must be processed as such. If you wish to see listing of these chemicals they are found in the Federal document 40 CFR 261.30-260.33. One of several websites on the internet is
http://www.washingtonwatchdog.org/documents/cfr/title40/part261.html/

Characteristic Chemical Waste

The next area for discussion is some what less black and white. Basically, there is wording within the regulations that states a waste can be considered hazardous waste, if it has the characteristics that could cause a hazardous situation, when disposal of that chemical is put into local garbage or waste streams. The characteristics mentioned within the regulations are corrosive, ignitable, reactive, and /or toxic.

Corrosive by EPA standards is anything with a pH reading lower than 2 and higher than 12.5. Also the regulation describes a material as being corrosive, if it shows reaction to a certain type of steel.

Ignitable is any substance that has a flash point below 140 ^{o}F. A substance is ignitable if it is capable under standard temperature and pressure of causing fire through friction, absorption of moisture or spontaneous chemical change or if it does catch fire it is extremely difficult to extinguish. Oxidizers overlap this category because of their potential to react and cause fires.

The third category is **reactive**. The following may help to define this broad category. A substance is considered reactive if it meets any of the following criteria

(1) It is normally unstable and readily undergoes violent change without detonation.
(2) It reacts violent with water
(3) It forms potentially explosive mixture with water or when mixed with water it generates toxic gases, vapor or fumes.
(4) It is a cyanide or sulfide bearing chemical waste
(5) It is readily capable of detonation if heated or shocked.
(6) It is an oxidizing or reducing agent

The final group is **toxic** waste and has a very lengthy and confusing definition. Mostly it is full of wording that suggest that if the chemical can be harmful to humans or the environment it is to be treated as a toxin. This means that most chemicals used in science laboratories can fall in this category because many chemicals used in science labs are at least slightly toxic to humans or the environment. So check MSDS sheets and Manufacturing information concerning this characteristic. If the MSDS sheets has wording which indicates toxic properties may exist, then the item should be disposed of as hazardous chemical waste.

The above information is not meant to be all encompassing. It only scratches the surface into understanding all the regulations which governs chemical waste at EKU. There are many on-line courses that one can take if your job at the University requires more detailed understanding of the federal regulation governing chemical waste.

CAMPUS PICK-UP DATE:_____

OUTSIDE CONTRACTOR PICK-UP DATE:_____

HAZARDOUS WASTE DISPOSAL

EKU Risk Management and Insurance

Million House Ext. 2-5523

(please print legibly)

Name of Contact Person: _____ Accumulation Start Date:_____

Department:_____ Building:_____ Room #:_____ Phone:_____

Contents (Chemical Name): _____ Amount: _____

Physical State (Solid, Semi-Solid, Liquid, Gas):_____ Weight (in lbs.): _____

CIRCLE the applicable one:

Flammable	Acid
Toxic	Corrosive
Poison	Explosive
Metal	Oxidizer
Base	Shock Sensitive

SPECIAL PRECAUTIONS:_____

PLEASE NOTE:

1. Tape 2 copies of this completed form to each waste item to be picked up
2. Damaged, leaking, or pressurized containers will be refused.
3. "Unknown" contents will not be accepted

CAMPUS PICK-UP DATE:_____

OUTSIDE CONTRACTOR PICK-UP DATE:_____

HAZARDOUS WASTE DISPOSAL

EKU Risk Management and Insurance

Million House Ext. 5523

(please print legibly)

Name of Contact Person: _____ Accumulation Start Date:_____

Department:_____ Building:_____ Room #:_____ Phone:_____

Contents (Chemical Name): _____ Amount: _____

Physical State (Solid, Semi-Solid, Liquid, Gas):_____ Weight (in lbs.): _____

CIRCLE the applicable one:

Flammable	Acid
Toxic	Corrosive
Poison	Explosive
Metal	Oxidizer
Base	Shock Sensitive

SPECIAL PRECAUTIONS: _____

PLEASE NOTE:

1. Tape 2 copies of this completed form to each waste item to be picked up
2. Damaged, leaking, or pressurized containers will be refused.
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College of Arts and Sciences
Chemical Waste Guideline
2007

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Lawrence Miller	College Safety Committee member	Date
Timothy Weckman	College Safety Committee member	Date
Marcia Pierce	College Safety Committee member	Date
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Marco Ciocca	College Safety Committee member	Date
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