KFUPM

Procedure for Chemical Waste Management

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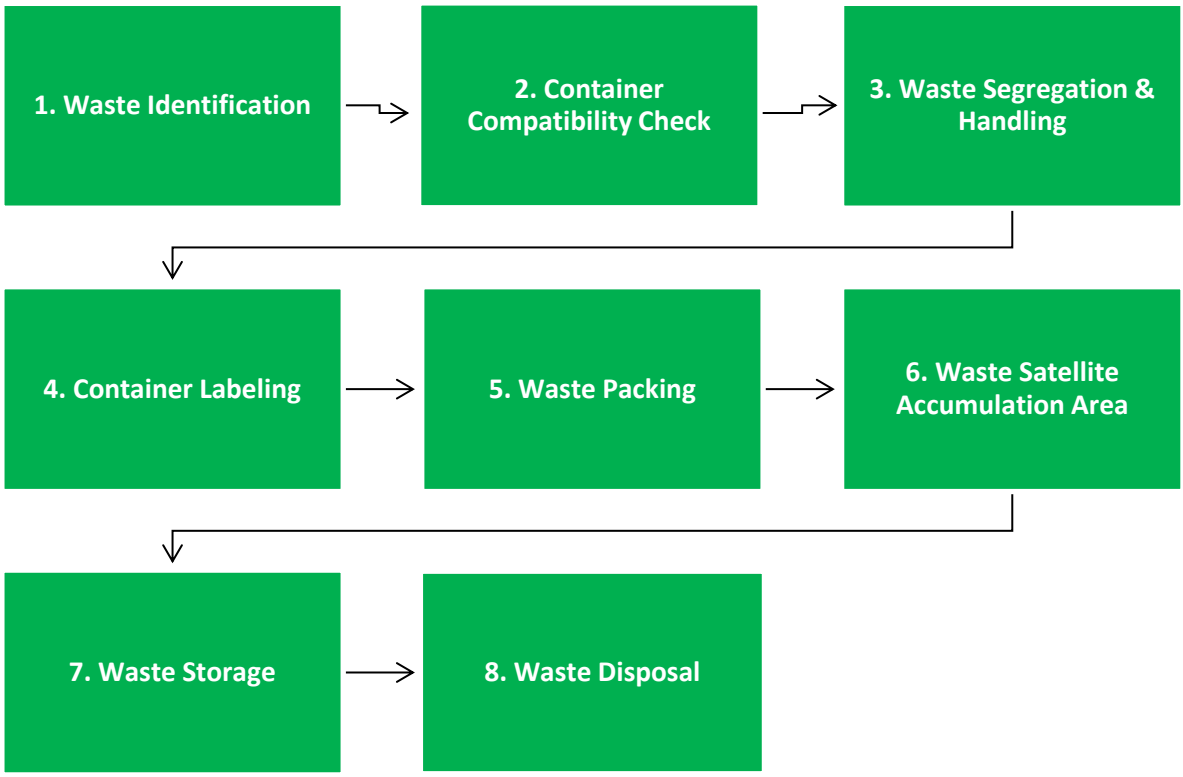
Environment, Health, and Safety Department

1.0 PURPOSE & SCOPE:

Chemical waste management is a critical aspect of maintaining a safe and sustainable environment within the university. This Chemical Waste Management Procedure provides university employees working with hazardous chemicals a detailed information on how to handle such wastes effectively. These wastes can be corrosive, flammable, radioactive, explosive, or react when exposed to other materials. This document outlines the responsibilities, procedures, and guidelines for the proper identification, segregation, storage, and disposal of chemical waste generated in the laboratories and other facilities at KFUPM. By adhering to these procedures, we aim to minimize the environmental impact, protect the health and safety of our community, and contribute to a cleaner and safer campus.

To ensure effective and safe management of your waste, please follow the chemical waste cycle illustrated in the figure 1.

Figure 1. Chemical Waste Management Steps



2.0 ABBREVIATIONS:

EHS	Environment, Health, and Safety
KFUPM	King Fahd University of Petroleum & Minerals
EPA	Environmental Protection Agency

SDS	Safety Data Sheet
HDPE	High Density Polyethylene
LDPE	Low Density Polyethylene
PET	Polyethylene terephthalate
PP	Polypropylene
PS	Polystyrene
PTFE	Polytetrafluoroethylene
PVC	Polyvinyl Chloride

3.0 DEFINITIONS:

Chemical Waste Management: Chemical waste management involves the proper handling, storage, and disposal of chemical waste to minimize its impact on human health and the environment.

4.0 RESPONSIBILITIES:

4.1 EHS Department

The EHS Department shall be responsible for overseeing the implementation of this procedure.

4.2 Heads of Departments

The Department Heads shall allocate the necessary resources and ensure implementation of this procedure. They shall also appoint a waste management coordinator for their department.

4.3 Waste Management Coordinator

The waste management coordinator of each department shall be responsible for:

- All labs are following the chemical wastes management procedure
- Provide labels for waste containers and forms to the lab supervisors
- Coordinate with the waste disposal coordinator for waste disposal
- Coordinate with the EHS department for the waste inspections, audits, and feedback

4.4 Waste Disposal Coordinator

The waste disposal coordinator shall coordinate with all the department about the waste disposal process, provide required labels and waste disposal form, and coordinate with the contractor for the waste disposal.

5.0 PROCEDURE:

5.1 Waste Identification

5.1.1 *Hazardous Waste*

Hazardous wastes generated from operational areas such as laboratories, intermediate storage areas, and engineering facilities—excluding general wastes—comprise solid, liquid, and gaseous substances. According to the Environmental Protection Agency (EPA), hazardous waste includes materials that exhibit hazardous characteristics such as toxicity, ignitability, corrosivity, or reactivity. Additionally, substances that are listed by the EPA as hazardous waste based on their usage or chemical constituents.

5.1.2 *Hazardous Waste Identification*

The identification of hazardous waste should be conducted utilizing Safety Data Sheets (SDS), bottle labels, and the regulatory guidelines specified in 40 CFR Part 261 Subparts B, C, and D. According to the Federal Environmental Protection Agency (EPA), a chemical waste material is classified as hazardous if it appears on the EPA's list of specific chemical substances or exhibits one or more of the four hazardous characteristics defined by the EPA: ignitability, corrosivity, reactivity or toxicity.

5.1.2.1 *Ignitability*

Wastes that are hazardous due to the ignitability characteristic include liquids with flash points below 60 °C, non-liquids that cause fire through specific conditions, ignitable compressed gases and oxidizers.

5.1.2.2 *Corrosivity*

Wastes that are hazardous due to the corrosivity characteristic include aqueous wastes with a pH of less than or equal to 2, a pH greater than or equal to 12.5 or based on the liquids ability to corrode steel.

5.1.2.3 *Reactivity*

Wastes that are hazardous due to the reactivity characteristic may be unstable under normal conditions, may react with water, may give off toxic gases and may be capable of detonation or explosion under normal conditions or when heated.

5.1.2.4 *Toxicity*

Wastes that are hazardous due to the toxicity characteristic are harmful when ingested or absorbed.

5.2 Container Compatibility Check

The selection of an appropriate container for storing hazardous chemical waste is critical to ensure safety and compliance with regulations. Therefore, adhere to the following precautions when selecting a chemical waste container:

5.2.1 *Chemical Compatibility*

- Ensure the container is made of material compatible with the chemical waste to prevent reactions, corrosion, or leaks. Chemical waste material should not react with it, weaken it, or dissolve it or its lid.
- The following basic guidelines should be considered:
  - Do not store acids or base in a metallic container

- Do not store Hydrofluoric acid in a glass container
- Organic solvents should not be stored in lightweight polyethylene containers

5.2.2 ***Container Condition***

- Choose containers that are in good condition, and free of cracks, dents, or any signs of damage.

5.2.3 ***Container Caps***

- All chemical waste containers should have leak-proof, screw-on caps to prevent spills and leaks.
- Corks or parafilm should not be used in place of proper caps.
- A container should be closed except when adding waste material to it. Evaporation of waste in fume hoods is STRICTLY PROHIBITED.

5.2.4 ***Container Size***

- Ensure the container size is appropriate for the volume of waste being stored, avoiding overfilling, 10% headspace is a good rule of thumb.
- Smaller quantities should be stored in smaller containers.

5.2.5 ***Secondary Container***

- Use secondary containment for liquid hazardous waste to provide additional protection against spills.
- A secondary container should also be chemically compatible. Generally, lab trays or dish-pans are used as secondary containers.

Container Types





5.2.6 ***Chemical Container Compatibility Chart***

Chemical Resistance Reagent (20°C)	HPDE	LDPE	PET	PP	PS	PTFE	PVC
Inorganic acids	E	E	N	E	E	E	E
Organic acids	E	E	E	E	E	E	N

Oxidizing agents conc.	G	G	N	G	G	E	N
Alcohols	G	E	E	E	E	E	E
Aldehydes	G	G	N	G	N	E	N
Amines	G	G	N	G	G	E	N
Bases	E	E	N	E	E	E	E
Ketones	G	G	N	G	N	E	N
Ethers	G	G	*	G	N	E	N
Esters	E	E	N	E	N	E	N
Glycols	E	E	*	E	G	E	F
Aliphatic Hydrocarbons	G	G	E	G	E	E	N
Aromatic Hydrocarbons	G	G	N	G	N	E	N
Halogenated Hydrocarbons	G	G	N	G	N	E	N
Mineral Oils	E	F	*	F	E	E	E
Vegetable Oils	G	G	*	F	*	E	G
Lubricating Oils	E	G	*	E	*	E	*

E – Excellent resistance; no damage after 30 days of exposure; plastic may even tolerate for years
G – Good resistance; little or no damage after 30 days of constant exposure
F – Fair resistance; some damage after 7 days of exposure
N – Not recommended; immediate damage may occur
***** – Information not available

HDPE - High Density Polyethylene
LDPE - Low Density Polyethylene
PET - Polyethylene terephthalate
PP - Polypropylene
PS - Polystyrene
PTFE - Polytetrafluoroethylene
PVC - Polyvinyl Chloride

5.3 Waste Segregation and Handling

The chemical waste from labs must be strictly segregated and disposed of separately. Care is taken not to mix chemicals together that would cause possibly dangerous reaction.

- Segregate solid waste from liquid waste.
- Segregate solid waste according to their hazard class and compatibility.
- Segregate liquid waste according to their hazard class and compatibility.

5.3.1 *Handling of Liquid Chemical Waste*

- Liquid waste shall be collected in compatible containers at source.
- Do not overfill liquid waste containers. Leave a sizable amount of head space in the container to allow for expansion and safe transportation — 10% headspace is a good rule of thumb.
- Do not mix solid with liquid waste.
- Keep organic solvents in separate containers.
- Do not mix organic solvents with toxic metal solutions.

- Use appropriate PPEs (Safety goggles, hand gloves, nose mask etc.) and take proper precautions during handling (packing, loading and transporting into the container) of Hazardous Waste.
- Always keep liquid waste containers in a compatible secondary container that can accommodate 100% of the waste container capacity.

Drain disposal of any kind of liquid chemical waste is strictly prohibited.

5.3.2 *Handling of Solid Chemical Waste*

Chemically contaminated solid waste can be divided into the following three categories:

5.3.2.1 *Lab Trash*

- Examples include absorbent paper products, Kim Wipes, gloves, and other lab supplies packed in proper bags.
- These bags should be labeled with accurate contents and chemical constituents.

5.3.2.2 *Dry chemicals*

- Use proper compatible containers for solid chemical waste material.
- Label the container with a hazardous waste tag.

5.3.2.3 *Empty Containers*

- Empty containers that once held extremely hazardous must be labeled with a hazardous waste tag, handled, and disposed of with the hazardous chemical waste.
- Do not mix empty hazardous containers with general waste.

5.3.2.4 *Sharps*

- Sharps are items capable of puncturing, piercing, or tearing regular waste bags. Examples include pipettes, pipette tips, needles, scalpels, razor blades, and broken glass. Use specific containers for glass.
- Sharps require special packaging with proper labels. Use specific containers for sharps.

Solid wastes shall be collected in poly bags with proper labels. Poly bags should be placed inside a solid waste container if there is a possibility of getting cut.

5.4 Labeling

Proper labeling of chemical hazardous waste containers is essential for ensuring safety and effective waste management. Here are the key aspects to consider:

- All containers must be labeled with the complete chemical name of each primary component. Formulas, acronyms, and abbreviations are not acceptable.
- If possible, the label should include the approximate percentage of each chemical.
- Do not place the words “Hazardous Waste” on the container, the specific hazard (e.g. flammable, corrosive, toxic, etc.) should be mentioned.
- Make sure all fields on the waste label are clearly filled.
- Make sure to remove or cover any old labels on the waste container and replace them with the new label.

- Writing with pencil (with thick letters) is highly recommended for label on organic waste solvents cans/ drums.

Sample label for the waste container are shown in Appendix-7.1.1. For Research Institute facilities, label stickers for the waste container can be requested from the RI Safety Unit. Facilities from all other departments at KFUPM can request label stickers from their respective department's waste management coordinator.

5.5 Packaging

Accumulated waste must be packed properly with the following considerations:

- Have spill clean-up materials and safety data sheet on hand before starting packaging.
- Select container as per the container compatibility procedure mentioned above.
- Segregate chemicals according to their hazard class and compatibility.
- Pack waste by using personal protective equipment appropriate for the materials being handled (safety glasses, lab coats, gloves, closed-toed shoes, etc.).
- Label chemical containers with the full chemical names and hazard warnings.
- Label the package following the labeling procedure mentioned above.

5.6 Satellite Accumulation Area for Chemical Waste

A satellite accumulation area is an area at or near a process that generates chemical waste. This area should meet the following safety requirements:

- It is close to the place where chemical waste is generated.
- It is under the control and surveillance of the person in charge of the laboratory.
- It is away from normal lab activities.
- It is labeled properly as “DANGER! HAZARDOUS CHEMICAL WASTE”.
- Fume hoods should not be used for chemical waste storage.
- Liquid waste should be stored in secondary containers.

The laboratory supervisor and user are responsible for following the procedures regarding satellite accumulation areas. It is necessary to provide appropriate type of containers (5-10 gallons) in each satellite accumulation region, classified by the types of chemical waste generated. For instance, metal drums, waste disposal bags, and plastic waste containers.

5.6.1 *Allowable Amount Accumulated*

Laboratories may accumulate as much as 5 gallons of hazardous waste or one liter of acutely hazardous waste (immediately hazardous to life and health) in compatible containers at or near any point of generation (Satellite Accumulation Area).

5.6.2 *Accumulation Time*

There will be no limit on accumulation time; however, once a container is full or more than 5 gallons of hazardous waste or 1 liter of acutely hazardous waste is accumulated, the full container or excess waste must be moved to the main accumulation area/chemical store within 72 hours.

5.7 Waste Storage

5.7.1 *Cleaning Chemical Spill*

Establish what chemical has been spilled and what personal protective measures should be followed. This information can be obtained from a Material Safety Data Sheet (MSDS) available in the lab. Strictly follow the specific standard procedures for cleaning up different types of chemicals.

Perform clean-up procedures only if:

- The appropriate spill control material, equipment, and protective clothing are available.
- Personnel are familiar with equipment and clean-up procedures as per the type of spilled chemical.
- More than one person is in the lab and available to participate. Work in teams. One person cleans the spill; the other should remain outside of the contaminated area and hand supplies to the person cleaning.
- There are no ignition sources present (for flammable spills).
- You are wearing the appropriate protective equipment required according to the type of chemical.
- Prior to commencing spill clean-up, ensure that you are wearing the appropriate protective equipment.
- Acids or Alkalis -first neutralize then absorb with a paper towel, cloth, or mop.
- Cover the mercury with Sulfur, then carefully remove it using a dustpan and broom. Place the collected material in a sealed container.
- If the spill involves highly hazardous substances, restrict access to the area, evacuate the area, and report it immediately to your Lab Supervisor.

5.7.2 *Transferring Waste Chemicals from the Lab to the Store (For Research Institute Only)*

The Lab Supervisor is the one responsible for handling and transportation, it is important to first understand the chemical characteristics of the materials to be moved. Here are some basic chemical handling practices to follow during your move, you can ensure your safety, as well as the safety of other people around you.

- Make a list of the chemicals and note the type (e.g. Acid, Base, Reactive, Toxic), and quantity of the chemicals to be moved. Use the Chemicals Transfer Form.
- Make sure that each container is correctly labeled as to its contents.
- Observe the general condition of each chemical container.
- Observe each container's cap or closure seal for the formation of crystals.
- Do not tighten, open or move containers that have crystals forming on the caps and seals.
- When moving chemicals, locating the Safety Data Sheets (SDS) for your chemicals is the most important step. Safety Data Sheets contain information that helps in identifying the proper methods of handling the chemicals.
- Schedule the day and time you need to move your chemicals with the store custodian.
- Choose the best route to take from your lab to the store room, do not take containers up and down stairs if possible. This will increase the risk of a spill It's important to group the containers for the move by Hazard Class. Do not move acids with toxics, or oxidizers with organic solvents. Make a separate move for each Hazard Class.
- Transfer salvageable chemicals from deteriorating or contaminated containers to new

containers with new labels. Properly dispose of unsalvageable and excess chemicals as Hazardous Waste.

- Liquid containers must be placed in secondary containment, like a tray or box that is compatible with the chemicals.
- If you use a cart to move containers make sure it has rails so the containers don't slip off. Place heavy containers on the bottom rack of the cart. Do not overload the cart, make several trips if necessary.
- Finally, make sure that you have a chemical spill kit with you in the event you have a spill along the move as well as the phone numbers to call in the event you have a spill along the move.
- Extra care should be taken when moving chemicals. A small accident can become an unmitigated disaster in a matter of minutes. Prepare for the worst and follow these tips to reduce potential damage.
- Stay with the containers. Do not let them out of your sight while you are moving them.

In the main waste storage area, it is necessary to utilize containers (25 L capacity) shown in the photo below to collect chemical waste from the satellite area.



5.8 Waste Disposal

For chemical waste disposal, the waste management coordinator of each department shall fill out the chemical waste disposal form and submit it to the chemical waste disposal coordinator, Dr. Adam Ahmed Abdullah Sulaiman (Core Research Facilities), email: adamahmed@kfupm.edu.sa. You can obtain the chemical waste disposal form by requesting it from the waste disposal coordinator.

However, for the Research Institute facilities, the person in charge of each laboratory shall fill out the chemical waste disposal form and submit it to the RI Safety Unit waste coordinator through email: crf-risu@kfupm.edu.sa.

A sample form for the chemical waste disposal is shown in Appendix-7.1.2.

6.0 REFERENCES:

Document Number	Document Title
KFUPM-EHS-F11	Chemical waste inspection checklist

7.0 APPENDIX:

7.1.1 Label Sticker for Waste Container - Sample





7.1.2 Chemical Waste Disposal Form – Sample

Sample Form for Chemical Waste Disposal

Name of Department or Center:	

S.No.	Type of waste	UOM	Quantity	Nature of hazard associated with waste					Type of Container				If mixture, proportion (approx.):				Date of Transfer
				Toxic	Explosive	Flammable	Corrosive	Unknown	Glass	Plastic	Metal	Other (explain)	Organic %	Inorganic %	Oil %	Other (explain)	
1	Acid Waste	LTR															
2	Alkaline Waste	LTR															
3	Oil Waste	LTR															
4	Soil Samples	KG															
5	Glasses & Bottles	KG															
6	Plastic Waste (Bottles)	KG															
7	Solvents (Organic)	LTR															
8	Solvents (Inorganic)	LTR															
9	Solid Waste (Organic)	KG															
10	Solid Waste (Inorganic)	KG															
11	Oil based Drilling Mud	KG															
12	Incinerables	KG															
13	Radioactive Materials	KG / LTR															
14	Mercury and its compounds	KG / LTR															
15	Cyanide and its compounds	KG / LTR															
16	Combined mixture	KG / LTR															
	Total Quantity			0	0	0	0	0	0	0	0	0	0	0	0	0	

Approval of Safety Coordinator

Name:	
Signature:	
Tel:	
Date:	