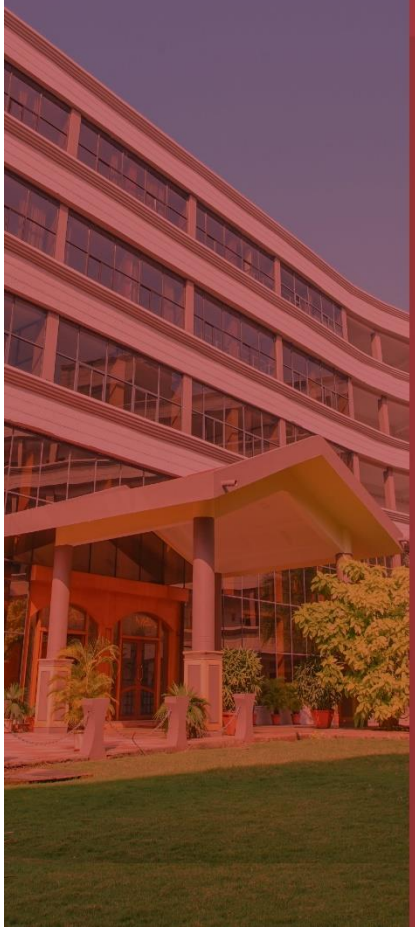

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STANDARD OPERATING PROCEDURE (SOP)

HANDLING HAZARDOUS CHEMICALS

(DEPT. OF PATHOLOGY)

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Department of Pathology

STANDARD OPERATING PROCEDURES FOR HANDLING HAZARDOUS CHEMICALS

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AMENDMENT SHEET

S.N.	Section no & page no	Details of the amendment	Reasons	Sign. of the preparatory authority	Sig. of the approval authority
1	Page 5	Laboratory employees must obtain prior approval by HOD to proceed with a laboratory task	For proper monitoring and avoiding untoward incidences		
2	Page 11	Chemical spills and PPE Waste	To emphasize on contaminated waste Disposal		

STANDARD OPERATING PROCEDURES

FOR

HANDLING HAZARDOUS CHEMICALS

(Dept. of Pathology)

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Evaluation of Potential and Known Hazards

Prior to initiating a new experiment or procedure, all laboratory employees must evaluate the potential physical and health hazards associated with its chemicals and processes.

Container labels as well as other references provided by the supplier/ manufacturers, will be used to conduct the evaluation.

Laboratory personnel will be familiar with their own and previous evaluations prior to beginning work, and will use appropriate ventilation, protective equipment and procedures to minimize exposure.

The evaluation will include preparation for any potential emergency.

Prior Approval

Laboratory employees must obtain prior approval to proceed with a laboratory task from HOD whenever:

- A new laboratory procedure or test is carried out;
- There is a significant change in a procedure or test likely to alter the hazard. A significant change is defined as a 10% or greater increase or decrease in the amount of one or more chemicals

  Used, a substitution or deletion of any of the chemicals in a procedure, or a change in the

  Conditions under which the procedure is conducted;
- There are unknown or unexpected test results;
- Members of the laboratory staff become ill, suspect exposure

Reporting Laboratory Incidents and Unsafe Conditions

Report all laboratory incidents no matter how minor to a supervisor.

Unusual or unexplainable chemical incidents should be discussed with others in the department, to caution others as to the risk of the procedure.

Report any unsafe conditions by contacting the HOD and filing a written report so that the condition may be corrected as soon as possible.

Unsafe conditions which must be reported include:

- Non-functioning hoods in areas where hazardous chemicals are being used;
- Unsafe storage conditions;
- blocked emergency exits;
- Improperly charged fire extinguishers;
- Inoperable eyewash stations or safety showers;
- Absence of personal protective equipment (PPE) (e.g, goggles, gloves) .

General Rules

Working with hazardous chemicals (and procedures) alone in a laboratory or chemical storage area is strictly PROHIBITED.

Lab personnel must schedule research and experiments involving hazardous substances and procedures so that other lab members are present.

Rules are as follows:

- Undergraduate teaching laboratories: A faculty member must be present in the lab at all times when undergraduate students are conducting experiments;
- Research Laboratories: Personnel working alone must contact Public Safety to make them aware of their presence in the facility and encourage them to periodically check on them. These personnel should plan a route of escape in case of an emergency;
- Wear appropriate eye protection at all times;
- When working with flammable chemicals, be certain that there are no sources of ignition near enough to cause a fire or explosion in the event of a vapor release or liquid spill;
- Use a tip-resistant shield for protection whenever an explosion or implosion might occur.

For the chemicals they are using, all employees should be aware of:

- The chemicals' hazards appropriate references provided by the supplying company;

• Appropriate safeguards (e.g. chemical fume hood, personal protective equipment, etc.);

• The location(s) and proper use of emergency equipment (e.g. emergency shower/eyewash, fire extinguisher, spill kit);

• How and where to properly store the chemical when it is not in use;

• Proper personal hygiene practices;

• The proper methods of transporting chemicals within the facility;

• Appropriate procedures for emergencies, including evacuation routes, spill cleanup procedures and proper waste disposal.

Personal Hygiene

• Never store food or beverages in storage areas, refrigerators, glassware, or use utensils which are also used for laboratory operations;

• Do not eat, drink, smoke, chew gum, or apply cosmetics in laboratories where chemicals or other hazardous materials (e.g., radioactive or biohazards) are present;

• Never mouth pipet. Always use a pipet bulb or other mechanical pipet filling device;

• Do not smell or taste chemicals;

• Wash areas of exposed skin well before leaving the laboratory;

• Confine long hair and loose clothing. Wear shoes at all times in the laboratory but do not wear sandals, perforated shoes or sneakers;

• Always wear clothing that completely covers arms and legs. While performing laboratory work, never wear short-sleeved T-shirts, short skirts, or shorts;

• Jewelry should not be worn which interferes with gloves and other protective clothing, or which could come into contact with electrical sources or react with chemicals.

Proper Equipment Use

• Use equipment only for its intended purpose;

• Inspect equipment or lab apparatus for damage before use. Never use damaged equipment such as cracked glassware, or equipment with frayed electrical wiring;

• Shield or wrap Dewar flasks and other evacuated glassware to contain chemicals and glass fragments should implosion occur.

Eye Protection

All personnel, students, and any visitors in locations where chemicals are stored or handled must wear protective goggles at all times.

Prior to use, personnel will verify that the equipment has been approved for the particular procedure

Standards require minimum lens:

Thickness of 3mm, impact resistance, passage of a flammability test, and lens-retaining frames.

Eye Protection Guidelines

Type of eye protection Condition Requiring Use

Standard goggles handling corrosive chemicals

Acid/Caustic goggles with side danger of splashing chemicals or flying particles shields

Impact protection goggles working with glassware under vacuum or elevated pressures; using glass apparatus in combustion or other high temperature operations

Face shields (protects face, throat and neck) potential for flying particles, harmful liquid

Both goggles and face shields vacuum system (danger of implosion); chemical reactions with potential for mild explosion

ORDINARY PRESCRIPTION GLASSES ARE NOT ADEQUATE TO PROTECT EYES FROM INJURY!

Guidelines for Use of Gloves

It is the responsibility of the lab supervisor and the employee, to choose and use the appropriate gloves.

Gloves must be worn whenever there is a chance for hand contact with chemicals, such as during the transfer of chemicals from one container to another or during the transfer of chemical wastes. Gloves must be worn if the chemicals involved are easily absorbed through the skin and/or are acute or chronic toxins.

When working with the corrosive liquids, also wear gloves made of material known to be resistant to permeation by the corrosive chemical and tested by air inflation **(do not inflate by mouth!)** for the absence of pin-hole leaks.

Lab personnel must inspect gloves prior to each use.

Gloves must be washed before removal except those that are easily permeated/degraded by water (e.g. leather, polyvinyl alcohol).

Prior to use, lab personnel will consult the glove manufacturer's permeation and resistance charts

(Available from the manufacturer) to make sure that the glove is appropriate for the chemicals being used.

Glove materials vary in the way they resist being degraded and permeated.

No glove totally resists degradation and permeation over time and must be replaced periodically, depending on frequency of use, chemical concentration, and duration of contact. The glove material and its thickness determine the appropriateness of a specific glove type.

Protective clothing which should be readily available to laboratory personnel include:

• Lab coats

• Boots

• Lab aprons

• Shoe Covers

• Gauntlets

• Jump suits/coveralls

Laboratory personnel must be instructed to consider the following characteristics in protective clothing selection and purchase:

• ability to resist fire, heat and the chemicals used;

• impermeability, when needed;

• comfort, permitting easy execution of tasks when worn

• ease of cleaning (unless disposable);

• ability to be removed quickly during an emergency or chemical splash (e.g. snap fasteners rather than buttons).

Safety Shields

Safety shields should be used on or near equipment when there is potential for explosion, implosion or splash hazards. Fixed shields will be used whenever possible, recognizing that their weight and resistance provides superior protection against minor blasts. Portable shields may be used when the hazard is limited to small splashes, heat or fire. Where combustion is possible, the shield must be made of flame-resistant material. It is the laboratory supervisor's responsibility to assure that shields are used appropriately. The sash of a chemical fume hood can serve as a splash or (minor) blast shield.Prior to large volume

purchases, personal protective equipment should be evaluated under real or simulated conditions to ensure that it meets both safety and performance standards. For example, chemical splash goggles may meet ANSI standards but fog up rapidly or are so uncomfortable that they will not be worn.

Transporting chemicals within College (between rooms and/or between buildings)

• Carry chemicals by hand in secondary containment (carrying bucket) to prevent breakage;

• Transport chemicals on stable, wheeled carts that move smoothly over uneven surfaces; cart shelving should have raised edges to contain chemicals if containers break;

• Laboratory employees transporting chemicals must wear goggles and lab coats;

• Use freight elevators whenever possible; passenger elevators only during periods of low use;

• Transport compressed gas cylinders using hand trucks with the cylinder strapped in place.

NEVER roll or drag cylinders. Keep the cylinder capped until used.

Housekeeping

• Keep all work areas, including work benches and floors, clean, dry and uncluttered;

• Access to emergency equipment, utility controls, showers, eyewash stations and laboratory exits must never be blocked;

• Label all chemical containers with the full chemical name(s) of the contents and hazards;

• Return all chemicals to their assigned storage areas at the end of each workday;

• Properly label all waste containers;

• Promptly clean up all chemical spills; properly dispose of the spilled chemical, cleanup materials;

• Chemicals must be stored in permitted laboratories and storage rooms only, in proper

secondary containment, in cabinets with lockable doors, or chemical shelving (storage rooms).

Working with Toxic Chemicals

Laboratory personnel usually are aware of the physical properties (reactivity, corrosivity, flammability) of the chemicals they use. They are often not aware of the toxicology of these same chemicals

Deposit chemical waste in their appropriate, labeled, receptacles and follow all other disposal procedures described in Chapter 5 of the CHP.

Be particularly cautious about releasing hazardous substances into designated cold rooms or warm rooms, since these facilities have recirculated atmospheres.

Minimize the release of toxic vapors into the laboratory by venting apparatus such as vacuum pumps and distillation columns into local exhaust system (i.e. chemical fume hoods). When especially toxic or corrosive vapors are involved, they should pass through scrubbers prior to being discharged from the local exhaust system.

Working with Flammable Chemicals

• In general, the flammability of a chemical is determined by its flash point, the lowest

temperature at which an ignition source can cause the chemical to ignite momentarily under certain controlled conditions.

• Chemicals with a flash point below 2000 F (93.3OC) will be considered "fire-hazard chemicals" (flammable or combustible);

• Fire-hazard chemicals must be stored in a flammable storage rooms or in flammable storage cabinets;

• Fire-hazard chemicals must be used only in chemical hoods, away from sources of ignition.

Laboratory Chemical waste Management

Laboratory waste containers

Packaging, labeling, and storage are the three requirements for disposing of chemical waste. (These guidelines are not applicable to biohazardous waste and radioactive waste).

Packaging

For packaging, chemical liquid waste containers should only be filled up to 75% capacity to allow for vapour expansion and to reduce potential spills which could occur from moving overfilled containers. Container material must be compatible with the stored hazardous waste.

In addition to the general packaging requirements mentioned above, incompatible materials should never be mixed in a single container. Precipitates, solids, or other non-fluid wastes are typically stored separate from liquid waste.

Labelling

All containers should be labelled with the group name from the chemical waste category and an itemized list of the contents. All chemicals or anything contaminated with chemicals pose a significant hazard. All waste must be appropriately packaged.

Storage

When storing chemical wastes, the containers must be in good condition and should remain closed unless waste is being added. The container should be sturdy and leak-proof and must be labelled. All liquid waste must be stored in leak-proof containers with a screw-top or other secure lid, not parafilm or other loose-fitting lids that can become dislodged in transit. A secondary containment (e.g., flammable cabinet or large plastic bin, etc.) should be used to capture spills and leaks from the primary container and segregate incompatible hazardous wastes, such as acids and bases.

Chemical Waste Containers

Every container of regulated chemical waste must meet the following minimum requirements.

Closure: Every chemical waste container must be tightly closed at all times; unless a user is in the process of pouring waste into the container. The only certain way to achieve this is with a tight-fitting screw cap tightly secured on the container.

Condition: Every chemical waste container must be in good condition; free of cracks, leaks and corrosion.

Compatibility: Every chemical waste container must be compatible with and resistant to the chemical wastes which are collected inside.

Labelling: Every container in must be labelled.

Each label, at a minimum, must include the following 4 elements:

The words “Hazardous Waste”

The name of the hazardous waste chemical (or chemicals) inside the container. These names must be spelled out in full, English words (no abbreviations or formulas are allowed).

A ‘statement of the hazard’ indicating which of the 4 hazard classes the chemical(s) exhibit. This is typically done by putting a check mark in the appropriate box on a pre-printed hazardous waste label.

Disposal of Unknowns

All chemicals must be identified and containers properly labelled at all times. Laboratory staff is responsible for seeing that this requirement is met in their laboratories.

If an unknown chemical is discovered, label it as “unknown-pending analysis” and attach a note detailing any information about what the chemical may be or what experiment it may have been used for and where it was found.

Chemical Spills and PPE Waste

In general, a material that is used to clean up a chemical spill (excluding equipment which is to be re-used) must be disposed of in the same manner as the chemical itself. Gloves, spill pads, absorbents, etc. which are used to clean up a chemical spill become chemical wastes themselves, subject to the same rules as the spilled chemical.

Personal Protective Equipment (PPE) such as gloves, and lab equipment such as pipette tips, which become contaminated with hazardous chemicals should be disposed of in the same manner as the chemical waste.

Pipette tips (which are not sharp enough to puncture skin) can typically be placed into the same container the chemical waste is collected in. Disposal lab coats and larger items which become contaminated can be sealed in a bag, tied closed, and then managed (labeling, etc.) as a chemical waste container.

MATERIALS THAT MAY BE DISPOSED OF THROUGH THE SANITARY SEWER SYSTEM

As per the guidelines given by: Yale's Environment and Safety Guidelines

Materials appropriate for sewer disposal in limited quantities must meet the following criteria:

- They are liquids and readily water soluble (at least 3%).
- Easily biodegradable or amenable to treatment by the waste water treatment process.
- Are simple salt solutions of low toxicity inorganic substances.

Chemicals that can be safely disposed of down the drain include biological compounds and cellular constituents such as proteins, nucleic acids, carbohydrates, sugars, amino acids amines, surfactants and many metabolic intermediates. Other compounds include soluble salt combinations of low toxicity ions and dilute (less than 10%) aqueous solutions of low molecular weight biodegradable organic chemicals such as alcohols, aldehydes, ketones, amines, ethers, nitriles and esters. Examples of materials in these categories include:

Soluble salt combinations of the following ions:

Cations	Anions
Aluminum (Al^{3+})	Bicarbonate (HCO_3)
Ammonium (NH^{4+})	Bisulfite (HSO_3^-)
Calcium (Ca^{2+})	Bromate (BrO_3)
Cesium (Cs^+)	Bromide (Br^-)
Hydrogen (H^+)	Carbonate (CO_3^{2-})
Lithium (Li^+)	Chlorate (ClO_3)
Magnesium (Mg^{2+})	Chloride (Cl^-)
Potassium (K^+)	Hydroxide (HO^-)
Sodium (Na^+)	Iodate (IO_3^-)
Strontium (Sr^{2+})	Iodide (I^-)
Tin (Sn^{2+})	Nitrate (NO_3^-)
	Nitrite (NO_2^-)
	Oxide (O_2^-)
	Phosphate (PO_4^{3-})
	Sulfate (SO_4^{2-})
	Sulfite (SO_3^{2-})

Note: Before discharging into sewer, make sure that all other criteria (such as pH, flammability, toxicity, etc. limits) are met.

Dilute (<5%) aqueous solutions of low molecular weight biodegradable organic chemicals appropriate for sanitary sewer discharge include:

Alcohols	**Amides**
Alkanols with fewer than 5 atoms Alkanediols with fewer than 8 atoms Sugars and sugar alcohols Alkoxyalk anols with fewer than 7 carbon atoms Butanol, 1-(n-Butyl Alcohol) Butanol, 2-(sec-Butyl Alcohol) Ethanol Ethanol, 2-(2-Butoxyethoxy) Ethylene Glycol Glycerol Methyl 1-Propanol, 2-(Isobutyl Alcohol) Methyl 2, Butanol, 2-(t-Amyl Alcohol) Methyl 2-Propanol, 2-(tert-Butyl Alcohol) Propanol, 1-(n-Propyl Alcohol) Propanol, 2-(Isopropyl Alcohol)	RCONH2 and RCONHR with fewer than 5 carbon atoms RCONR2 with fewer than 11 carbon atoms Formamide Propionamide Methylpropionamide, N- Butanamide Aliphatic aldehydes with few than 5 carbon atoms
Aldehydes	**Amines**
Aliphatic aldehydes with fewer than 5 carbon atoms Butyraldehyde Gluteraldehyde Propionaldehyde	Aliphatic amines with fewer than 7 carbon atoms Aliphatic diamines with fewer than 7 carbon atoms Benzylamine Butylamine, N-

Carboxylic Acids	**Ketones**
Alkanoic acids with fewer than 6 carbon atoms Alkanedioic acids with fewer than 6 carbon atoms Hydroxyalkanoic acids with fewer than 6 carbon atoms Aminoalkoanoic acids with fewer than 7 carbon atoms Ammonium, Sodium, and Potassium salts of the above acid classes with fewer than 21 carbon atoms Acetic Acid Citric Acid Oxalic Acid Potassium Binoxalate Propanoic Acid Sodium Acetate Sodium Citrate	Ketones with fewer than 6 carbon atoms Pentatone, 2-
Esters	**Nitriles**
Esters with fewer than 5 carbon atoms Isopropyl Acetate Methyl Acetate Methyl Formate Methyl Propionate Propyl Formate, n-	Propionitrile
Ethers	**Sulfonic Acids**
Dioxalane	Sodium or Potassium salts of most are acceptable

Note: Before discharging any of these materials to the sanitary sewer, make sure all other criteria (such as pH limits and flammability) are met.

When discharging waste to the sanitary sewer, you should:

- Never dispose of anything that might lead to a storm sewer rather than a sanitary sewer.
- Use a sink that does not have a history of clogging or overflowing.
- Use a sink in your laboratory, preferably in a hood.
- Flush with at least 10-20 fold excess of water after drain disposal to thoroughly rinse out the sink and sink trap, and to dilute the waste.
- Limit the quantities being discharged to 100 grams of solute per laboratory per day.
- Wear gloves, eye protection and a laboratory coat.
- Inactive biological materials (e.g., autoclave or bleach-treat) before releasing to sewer.

Waste Minimization

Effective management is the key to minimizing the risks associated with hazardous chemical waste. Every member of the laboratory can take steps to minimize the volume and toxicity of chemical wastes that are generated.

Inventory Management

Maintain an up-to-date inventory of the chemicals in your laboratory to avoid re-purchasing existing materials and to understand usage patterns.

Only purchase the amount of chemical you will need in the short term. Buying in bulk never makes financial sense when the risks of storage and the costs of disposal are considered.

Use inter departmental system to identify co-workers in your institute who might have a chemical that you need.

Dispose of outdated or unwanted chemicals immediately. Some materials, such as peroxide-forming chemicals, become more dangerous over time. It is much safer and much less expensive to get rid of ether that does not have significant peroxide formation.

Label all chemical containers, regardless of what's inside

Only purchase cylinders from companies who will pick them up when empty.

Scaling and Substitution

Consider using microscale experiments to reduce the volume of chemical wastes generated.

Avoid unnecessary dilutions in experimentation which might increase the volume of hazardous waste generated.

Substitute less hazardous materials into experiments, for example:

Use biodegradable detergents instead of toxic, chromium-based cleaners

Use non-mercury thermometers

Select non-mercury preservatives, and choose products such as antibodies which have been manufactured using non-mercury preservatives

Preserve specimens in ethanol instead of formaldehyde which is much more toxic

Use non-halogenated solvents in place of halogenated solvents wherever possible to reduce toxicity and disposal costs

Use sodium hypochlorite instead of dichromate

Use scintillation cocktails which are non-toluene/xylene based

Eliminate metal catalysts whenever practical, even if it means longer experimentation times

Purchase chemicals pre-mixed or in the desired concentration to avoid unnecessary experimental steps and unneeded chemical stores

Substitution of ethanol in place of methanol in experiments can often provide more waste management options.

Recycling

If possible achieve chemical concentrations that can be reused and consumed at source only instead of generating waste.

List of Chemicals in Dept. of Pathology

H: Hazardous

I: Inflammable

Chemical waste generated after the experiments or practical will be collected in lab and processed accordingly to make is sewage ready for disposal.

SN	Chemical	Remark	
1	Alcohol- Isopropyl	H/I	Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.
2	Acetic Acid	H/I	Neutralization with NaOH to ph of 6 To 8 then dilution with distilled water to less than 5%. Further flush in sewer system with water in 1:10 dilution.
3	Acetone	H/I	Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.
4	Activated Charcoal		
5	Ammonia	H	Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.
6	Ammonium Sulphate	H	Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.
7	Antisera-ABD		
8	Basic Fuschsin		
9	Barium Chloride	H	Make aqueous solution less than 3% then flush in sewer with water.
10	Benzidine Powder	H	Make aqueous solution less than 3% then flush in sewer with water.
11	Benedict’s Reagent		
13	DPX		

14	Disodium Phosphate	H	Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.
15	Di sodium Hydrogen	H	Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.
16	Eosin		Filter and reuse for staining
17	Ehrlich Aldehyde Reagent	H	Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.
18	Fouchets Reagent		Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.
19	Formalin	H	Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.
20	Haematoxylin		Filter and reuse for staining
21	HCl	H	Neutralization with NaOH to ph of 6 To 8 then dilution with distilled water to less than 5%. Further flush in sewer system with water in 1:10 dilution.
22	Leishman Stain		Dilution with buffer or tap water in proportion on 1:10 and dispose off in sewer system.
23	Mercuric Acid	H	Neutralization with NaOH to ph of 6 To 8 then dilution with distilled water to less than 5%. Further flush in sewer system with water in 1:10 dilution.
24	Picric Acid	H	Neutralization with NaOH to ph of 6 To 8 then dilution with distilled water to less than 5%. Further flush in sewer system with water in 1:10 dilution.
25	Periodic Acid	H	Neutralization with NaOH to ph of 6 To 8 then dilution with distilled water to less than 5%. Further flush in sewer system with water in 1:10 dilution.
26	Sodium Chloride		
27	Sodium Taurocholate	H	Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.
28	Sodium Thiosulphate	H	Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.
29	Xylene	H/I	Dilution to less than 5% with distilled water then flush with 1:10 with water proportion in sewer system.

Dispose of the chemical waste is as per the guidelines given by: Yale's Environment and Safety Guidelines mentioned above.

Maximum efforts to be made for minimal to nil waste generation by using Inventory Management, Scaling and Substitution, Recycling as per guidelines given above.