LABORATORY WASTE MANAGEMENT PLAN

INSTITUTE OF ENVIRONMENTAL SCIENCES

BOGAZICI UNIVERSITY

LABORATORY COMMISSION

SAFETY AND WASTE MANAGEMENT TEAM

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Forward

As a chemical waste generator, all Research Laboratories located at Institute of Environmental Sciences (IESC), Bogazici University, are required to comply with “Atık Yönetimi Yönetmeliği” and “Tehlikeli Atıkların Kontrolü Yönetmeliği” [1,2]. These regulations cover the classification, handling and documentation of transfer process of hazardous waste for the final disposal.

This Laboratory Waste Management Plan (LWMP) was partially adapted from Laboratory Waste Management and Hygiene Plans of Gettysburg College (USA), University of Pennsylvania (USA), University of Wollongong (Australia), Western Carolina (USA) and Ege University (Turkey). This plan also partially complies with laboratory waste management provisions specified by EPA 40 CFR to improve environmental performance in academic laboratories that meet major requirements for separation of hazardous and non-hazardous wastes, classification of chemical/hazardous waste, storage, handling, minimization and disposal.

This Laboratory Waste Management Plan is applied only to laboratories working under the Institute of Environmental Sciences. These are as follows:

- Environmental Analysis Laboratory
- Teaching Laboratories
- Research Laboratories
- Laboratory Chemical Stockrooms
- Laboratory Cold Room
- Hazardous Waste Storage Room

Contents

Responsibilities

Safety and Waste Management Team

The Safety and Waste Management Team (SWMT) is responsible for managing the records of laboratory waste inventory, characterization of waste, assisting with the waste determination and proper separation at source, receiving hazardous wastes from research laboratories that was identified with proper labeling to store at Hazardous Waste Storage Room.

Safety and Waste Management staff conducts the transfer of hazardous wastes from individual research laboratories to the Hazardous Waste Storage Room prior to their final disposal.

Supervisors or Principal Investigators

Supervisors or the Principal Investigator of each laboratory are responsible for:

- characterizing and separating laboratory waste
- keeping the waste in appropriate containers
- labeling each container properly
- managing safe spaces for waste in their laboratory
- delivering waste to Safety and Waste Management Team member at an appointed date

Students

All researchers and students who generate chemical/biological waste must follow the guidelines in the Laboratory Waste Management Plan. They are responsible for ensuring the appropriate handling of waste containers, proper labelling and safe delivery to SWM-staff at a scheduled date. SWMT-member is informed by an e-mail about the content and hazards of chemical waste before transfer to HWSR and a digital copy of waste label is sent to SWMT-member.

LABORATORY WASTE MANAGEMENT PLAN

Section 1.

1. Principles of hazardous chemical material management

a. Minimize the amount of waste generated inside the laboratory.
b. Follow all instructions suggested in Material Safety Data Sheets (MSDS) of chemical products and in this plan.
c. Classify laboratory waste and identify hazards properly.
d. Only use appropriate containers for the storage of waste materials.
e. Store chemical waste in every lab at a safe and identified area.
f. Label all waste containers as described in this plan.
g. Keep the caps of waste containers closed all the time.
h. Contact with SWM-staff for pick-up. Send a copy of waste label by e-mail to inform about waste and hazard identification. Take your waste code for the inventory.

2. Waste Minimization

It is suggested to develop and implement a Waste Minimization Strategy for each individual laboratory. It is aimed to reduce chemical waste generation and establish a sustainable chemical consumption in IESC Laboratories. It is advised to follow some general ways to help achieve this goal include but are not limited to [4, 5]:

a. Simply purchase chemical materials as small quantities as possible
b. Keep an inventory of chemicals used and/stored in lab and share surplus chemical with other labs whenever possible.
c. Prefer mercury-free instruments.
d. Substitute hazardous chemicals with non-hazardous chemicals.
e. Reduce the scale of laboratory experiments to decrease the volume of waste being produced whenever possible.
f. Segregate wastes to simplify the treatment, not mix hazardous waste with non-hazardous waste and keep waste streams as simple as possible
g. Consider the neutralization of acids and bases to convert them non-hazardous solvents as a final step
h. Consider the precipitation of toxic metals from aqueous streams as the final step

3. Waste Definition and Classification

Non-Hazardous Wastes

Any waste not included in the definition of “hazardous waste” described as a “non-hazardous waste.” Any material meeting the definition of non-hazardous waste may be disposed as regular municipal waste to the trash or sanitary sewer [6].

Recyclable Wastes

Recyclable laboratory waste includes uncontaminated materials, such as cardboard, paper, plastic or glass containers or bottles that are not suitable for reuse. They are collected in separate containers provided for paper, plastic and glass material located at general laboratory.

Hazardous Waste

A hazardous waste is a solid, liquid, or gaseous material that displays either a "Hazardous Characteristic" or is specifically "listed" by name as a hazardous waste. The wastes which exhibit one or more characteristics given below are regulated as hazardous waste [4].

The **Ignitability** characteristic applies to wastes that are:

- Liquids with a flash point less than 60°C and at least 24% alcohol by volume
- Oxidizing chemicals
- Ignitable compressed gases
- Spontaneously combustible solids under normal temperature and pressure
- Examples; waste oils, used solvents, ethanol, sodium nitrate, hydrogen gas, xylene and acetone

Corrosivity characteristic applies to wastes that are:

- Liquids with a pH less than or equal to 2 or greater than or equal to 12.5 that are capable to corrode metal containers.
- Not apply to solid materials
- Examples include battery acid, hydrochloric acid, nitric acid, and sodium hydroxide

The **Reactivity** characteristic applies to the following:

- Materials that are not stable under normal conditions
- Reactive materials can react violently or generate generates toxic gases, vapors, or fumes causing explosion when mixed with water
- Cyanide or sulfide bearing wastes which evolve toxic gases, vapors or fumes when mixed with acids or bases at pH conditions between 2 and 12.5
- Examples include nitroglycerin, sodium metal, perchlorates, reactive sulfides, potassium cyanide, peroxides, picric acid

The **Toxicity** Characteristic applies to to the following:

- Wastes that are harmful or fatal to human health or the environment when ingested or absorbed

- Toxic materials are regulated as hazardous waste due to their potential to leach from the waste and pollute ground water

The determination of hazardous wastes must be performed in the lab whenever waste is generated. SWM staff takes the responsibility for picking up all of the waste chemicals generated at each laboratory and for checking the final hazard status of waste. Annex 1 describes all hazard symbols and Annex 2 gives some examples of chemicals under these hazardous classifications. Table 1 summaries the list of toxic chemicals and level of toxic effects.

Table 1. The list of toxic contaminants and level of potential toxic effects [3]

Contaminant	Level (mg/L)	Contaminant	Level (mg/L)
Arsenic	5.0	m-Cresol	200.0
Barium	100.0	Cresol	200.0
Cadmium	1.0	1,4-Dichlorobenzene	7.5
Chromium	5.0	1,2-Dichloroethane	0.5
Lead	5.0	1,1-Dichloroethylene	0.7
Mercury	0.2	2,4-Dinitrotoluene	0.13
Selenium	1.0	Heptachlor	0.008
Silver	5.0	p-Cresol	200.0
Endrin	0.02	Hexachlorobenzene	0.13
Lindane	0.4	Hexachlorobutadiene	0.5
Methoxychlor	10.0	Hexachloroethane	3.0
Toxaphene	0.5	Methyl ethyl ketone	200.0
2,4-D	10.0	Nitrobenzene	2.0
2,4,5-TP Silvex	1.0	Pentachlorophenol	100.0
Benzene	0.5	Pyridine	5.0
Carbon tetrachloride	0.5	Tetrachloroethylene	0.7
Chlordane	0.03	Trichloroethylene	0.5
Chlorobenzene	100.0	2,4,5-Trichlorophenol	400.0
Chloroform	6.0	2,4,6-Trichlorophenol	2.0
o-Cresol	200.0	Vinyl chloride	0.2

What is MSDS form?

Material Safety Data Sheet (MSDS) of a chemical product gives basic information about the composition of ingredients, its physical and chemical properties, stability, reactivity, toxicological and ecological information, hazard identification, handling, storage and disposal considerations, first-aid, fire-fighting and accidental release measures, and exposure controls. To comply with the recommendations given under MSDS is essential for safe handling and waste management of laboratory generated chemical waste.

4. Segregation and Handling of Wastes

Waste generators are encouraged to segregate laboratory waste according to its properties to facilitate the safe and most convenient storage and disposal of laboratory wastes [6]. These categories should be as follows:

- aqueous acidic
- aqueous alkaline
- aqueous organic
    - halogenated
    - non-halogenated
- organic solvents
- heavy metal contaminated wastes
- peroxide forming chemical wastes
- gas producing waste streams
- general hazardous waste – soil, powders etc.
- toxic flammable wastes
- mercury and inorganic of mercury salts
- inks/dyes/pigments/sludge
- waste oil
- miscellaneous waste

Hazardous wastes should be subcategorized according to their hazards and hazard information take place in MSDS forms should be taken into account for the necessary precautions for safe waste storage in each individual laboratory. Annex 3 describes chemicals that should never be collected in the same waste container.

Acute Reactive Wastes

Reactive wastes which include one or more of the following chemicals must not be mixed with any other wastes in the same container [6].

- Aluminum Phosphide
- Ammonium Picrate
- Mercury Fulminate
- Nitroglycerine
- Tetranitromethane
- Zinc Phosphide (>10%)

Gas Producing Waste Streams

Gas producing chemical mixtures should be stored wisely to prevent pressurizing or explosions [4].

- **Aqua regia:** a mixture of concentrated nitric acid and hydrochloric acid
- **Piranha solution:** a mixture of sulfuric acid and hydrogen peroxide

Poly containers with special vented caps are required for the storage of gas producing chemical wastes. Glass bottles must not never be used since they may pose an explosion risk due to pressurization. A secondary waste bucket is suggested for gas producing wastes.

Compressed Gas Cylinders

Compressed gas cylinders must be stored properly, labeled with the content and fixed to benches or walls [4]. The empty gas cylinders must be returned to the vendor.

Mercury Containing Items

Mercury containing items must never be collected with regular waste. These materials such as thermometers, thermostat switches and manometers must be collected separately for safe disposal [4].

Mixed Waste

A waste that has both hazardous and radioactive properties is defined as mixed waste such as Uranyl Nitrate and any mixture of a long lived isotope with a flammable solvent [4]. The storage and disposal conditions should be discussed before the first generation of the waste because these types of waste requires additional precautions The generator should inform SWM team about the content and quantity of waste before starting to accumulate.

Non-Specific Source Wastes

Spent solvents are generally defined as hazardous waste and disposed accordingly [6]:

- Tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, o-dichlorobenzene, trichloro-fluoromethane, and 1,1,2-trichloroethane.
- Xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, nbutylalcohol, cyclohexanone, and methanol.
- Cresols and cresylic acid, and nitrobenzene. Also, still bottoms from the recovery of acetone.
- Toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane.

Non-Hazardous, but Dangerous Wastes

Waste generators should be aware of some non-regulated chemicals that may be hazardous in some way. As a best management practice, wastes such as ethidium bromide, genetoxic agents, metabolic poison are managed as hazardous.

Unknown Materials

Containers of unknown materials must be labeled as “unknown” providing any available information about the content and hazard.

Peroxide Forming Chemicals

Peroxide-forming chemicals in solid, liquid or gas form may generate shock-sensitive and explosive peroxide crystals which will explode when triggered by friction or shock [3]. These chemicals may also be flammable or reactive.

After the contact of these chemicals with air, peroxides may form depending on the amount of air exposure, the specific chemical and the inhibitor content of chemical. Therefore, it is essential to take under control the use and storage of peroxide forming chemical in the laboratory. These chemicals should be kept at dark and away from heat with secured caps. The expiration and opening dates should be recorded and disposed according to their classes. The classes of peroxide formers are listed in Table 2.

Table 2. The classes of peroxide formers [3,4]

Class A	**Class B**	**Class C**
These chemicals pose an explosion risk on the shelf. These chemicals should be tested before use or disposal three months after opening or at the expiration date if unopened.	These chemicals pose a risk through evaporation or upon distillation of the solvent if only the peroxides are concentrated. These materials should be disposed of 1 year after opening or at the expiration date if unopened.	Class C peroxide formers may auto-polymerize as a result of peroxide formation. These materials should be disposed of 1 year after opening or at the expiration date if unopened.
Expire 3 months after opening	**Expire 1 year after opening**	**Expire 1 year after opening**
Isopropyl ether Vinylidene chloride Butadiene Chlorobutadiene (chloroprene,liquid monomer) Potassium amide Potassium metal	Acetal 2-Cyclohexen-1-ol Acetaldehyde Cyclopentene Benzyl alcohol Decahydronaphthalene (decalin) 2-Butanol Dioxanes	Butadiene Vinyldiene Chloride Chlorobutadiene Vinyl Acetylene Chloroprene Vinyl Chloride Vinyl Acetate Vinyl Pyridine

Sodium amide Tetrafluoroethylene Divinyl acetylene	Diacetylene (butadiyne) Chlorofluoroethylene Dicyclopentadiene Cumene (isopropylbenzene) Diethylene glycol dimethyl-ether (diglyme) Cyclohexene Methyl-isobutyl ketone Diethyl ether 4-Methyl-2-pentanol Ethylene glycol ether acetates (cellosolves) 2-Pentanol Furan 4-Penten-1-ol 4-Heptanol 1-Phenylethanol 2-Hexanol 2-Phenylethanol Methyl Acetylene Tetrahydrofuran 3-Methyl-1-butanol Tetrahydronphthalene Vinyl Ethers Other Secondary Alcohols Methyl-isobutyl ketone	Chlorotrifluoroethylene Styrene Tetrafluoroethylene

Testing for Peroxide: Peroxide detection strips should be used to check for peroxides. If unsafe peroxide levels (>50ppm) are detected, it is recommended to contact with SWMT-member. In this manner, all expired peroxide-forming chemicals must be tested for peroxides. In case of unsafe conditions (appearance of peroxide crystals around the cap or solid crystals inside the bottle) do not disturb containers and immediately deliver to SWMT-member.

Waste Oil

Waste oil commonly collected from various laboratory equipment such as vacuum pumps, or waste samples. These oils or metal contaminated oily wastes should be collected in a proper waste container and labeled with appropriate information.

Disposal Of Chemically Contaminated Needles & Syringes

Needles, syringes contaminated with chemicals and razor blades as infectious waste must be disposed properly placing them inside a sharps container [4]. These sharps containers should be labeled as “Chemical Contaminated Sharps –Do not Autoclave”.

Empty Containers

All empty chemical containers must be "triple rinsed" before disposal with a proper cleaning solvent. It is important to note that empty containers used for collection of acutely toxic hazardous wastes must be disposed as hazardous waste and these containers should not be rinsed. The containers used for odoriferous materials (thiols or mercaptans) should be placed into a secondary bag and stored under a fume hood until to collection [4].

5. Drain Disposal of Chemicals

The compounds which are assumed to be suitable for drain should be water soluble at least 3%, present a low toxicity hazard, and have a pH between 6 and 10. Before deciding to drain, it is recommended to i) check MSDS forms, consider the hazards and toxicity of the materials well and verify that the material may be safely disposed of to the sanitary sewer and ii) check the list given below for prohibited discharges. It is also important to note that only a limited quantity of these chemicals are allowed to be disposed into the sewage and it must be avoided to dispose in rain drainage [5]. The chemicals should be highly diluted flushing with at least 100-fold excess water and the water should be drained at maximum flow for 50 mL/min [5]. During the disposal process, the proper protective equipment (lab coat, goggles, gloves) must be wore and splashes should be avoided. Chemicals that are not appropriate for drain disposal are to be collected following hazardous waste disposal procedures.

Prohibited and/or not suitable discharges to the sanitary sewer [5]:

- Wastes with a fire or explosion risk
- Solid or viscous wastes in large quantities
- Heated waste above 40 ^{o}C
- Any toxic waste materials in volumes or strengths to cause interference with wastewater treatment processes
- Acids with a pH less than 6.0
- Bases with a pH greater than 10.0
- Odorous chemicals

- ❖ Alcohols, ethers, esters, ketones, aldehydes, amines, amides, nitriles, ethidium bromide, carbon disulfide, phenol or phenolic materials, halogenated or non-halogenated hydrocarbons, or other chemical agents, chromic acid
- ❖ Formaldehyde containing wastes
- ❖ Solutions contaminated with heavy metals
- ❖ Sodium azide containing wastes

6. Biological Waste Management

Biohazardous waste or biowaste generated from biological sources or used in the diagnosis, treatment, immunization or research may consist of solids, liquids, sharps, and other wastes that are potentially infectious [5]. Microbiological Waste may typically include;

- biologicals defined as serums, antigens, antitoxins, cell lines, and cultures
- discarded live or attenuated biological toxins
- nutrient agars, gels, and broths
- plastic or glass plates, paper, gloves, growth media, gels, filters, stoppers, plugs, flasks, inoculation loops and wires, pipette tips, tubes, stirring devices, jars used to transfer, inoculate or mix cultures

If a biowaste is contaminated with any hazardous chemicals, firstly, it must be decontaminated and then the material is treated as hazardous waste. Solid microbiological waste should be autoclaved before disposal in the landfill. Liquid biological waste (not containing hazardous chemicals) can be autoclaved or disinfected with bleach and then disposed of down the drain [5].

7. Container Management

Each research lab should meet general requirements for container management.

- All instructions provided by MSDS of relevant chemicals and this guideline must be followed for the management of laboratory waste
- Waste containers stored in each individual laboratory must be:
  - In good condition
  - Compatible with the waste being stored
  - Not over filled beyond 80%
  - Kept closed at all times except when filling
  - Labeled with a chemical waste label (Annex 4)
  - Stored inside secondary containment bins if necessary
- Waste must always remain in the lab, never store waste at public areas such as hallways
- Chemical substances that should not come into contact with each other are listed in Annex 1. A particular attention should be paid not to contact waste of chemicals since the interaction of incompatible chemicals can cause accidents.

- Chromic acid used for glassware cleaning should never be poured into the sink or mixed with other chemicals. Acetic acid, nitric acid, perchloric acid and chromic acid should never be mixed with each other. These waste solutions should be stored in a separate bottle.
- Waste organic solvents (if it is a single solvent) should be collected in separate bottles without mixing with others.
- If there is a mixture in the same container, the composition should be given in detail on the label.
- Vials filled with spent solvent and contaminants are collected separately in a secondary container and labeled.
- Chemical wastes in quantities lower than 500 mL should be waited until enough quantity is collected before pick up.
- Contaminated heating bath oils and vacuum pump oils should be stored in a separate container. It should be noted on the bottle with a warning "Only Waste Oil – Do not Put Solvent".
- Waste generators should keep their solid waste separately i. sharp items, ii. contaminated plastics, iii. contaminated glassware, iii. contaminated soil, nanoparticles, filter papers, and powders etc.

Working Containers

A working container is a container used to collect wastes from a laboratory experiment or procedure which has a volume less than 2.5 L [6]. A working container may remain open until the end of the procedure at a laboratory bench or hood unless it does not pose an inhalation risk but it should not be left over on the work station.

Waste Containers in Common Use

Waste generators must throw their waste in identified waste bins located at general analysis laboratory area.

Containers located at the general analysis laboratory are:

1. Recycle bins: plastic, paper, glass, metal
2. Contaminated gloves and tissue

Container Labeling

All waste containers must be labeled with a proper information using the template of Waste Label (Annex 4) [4,6,7].

- All sections of the label must be filled when the waste is fist started to be collected. Some information such as quantity of chemicals or additional constituents may be added later.
- Use only full name of chemicals not symbols or abbreviations for identification

Please keep in mind that without required information, the waste material cannot be picked-up for storage. This information will be used to manage safe storage of the material. Furthermore, environmental laws and disposal protocols require proper classification and

labeling of chemical waste. It is also important for the proper arrangement of containers at the Hazardous Waste Storage Room.

What to Control before Waste Transfer to Storage Area?

All waste materials containerized by generators according to given guidelines are received by SWMT-member by reviewing the following questions:

Table 3. Check List for Safe Waste Transfer to HWSR [5]

LIDS	securely closed	☐
	proper lids	☐
LEAKS	good condition	☐
	stored in secondary containment if necessary	☐
LABELS	properly labeled	☐
	waste code	☐
	generator	☐
HAZARD IDENTIFICATION	any special hazard mark on label	☐
PERSONAL PROTECTIVE EQUIPMENT	special personnel protective equipment requirement	☐

Handling of Containers [6]

1. All waste containers must be kept closed at all times
2. All containers must be classified according to subcategories identified on labels before transfer to HWR.
3. All labelled containers should be handed over to Safety and Management staff at a scheduled time and previously informed by an e-mail about the material and hazard identification sending a digital copy of waste label.
4. All waste containers must be kept at a safe place until it's transfer to Hazardous Waste Room.
5. During transfer of hazardous chemical waste, trained staff should follow safety rules and protocols with appropriate personal protective equipment.

8. Chemicals Which Should Never Be Stored Together

The storage of incompatible chemicals closely together may pose a risk of fire, explosion and toxic release risk due to unenviable chemical reactions. These chemicals should always be stored at least 3 to 5 meters apart depending on the violence of expected reaction. Therefore, incompatible chemical should also never be collected in the same waste container. The list of these chemicals are given in Annex 3.

Section 2.

1. Waste Management Training for Lab Personnel

All laboratory personnel, staff and students are trained on laboratory waste management procedures administered by Laboratory Commission according to this Safety and Waste Management Plan. Training on Laboratory Waste Management are given at the beginning of academic semester to all students who will work at laboratory.

2. On-Site Transfer of Laboratory Waste

Hazardous Waste are collected by a trained Safety and Waste Management personnel and transferred to Hazardous Waste Storage Room.

- Trained personal should wear appropriate personal protective equipment: face mask, gloves, googles, and chemical resistant apron if necessary.
- Classified chemical wastes should be transferred to the HWST one by one.
- Peroxide forming chemical wastes should be moved without agitation or bumping.
- Gas producing wastes must be stored in poly containers equipped with a special vented cap and moved carefully in a secondary waste bucket.

3. Waste Inventory

Recording an inventory list of collected hazardous waste materials is essential for establishment of a safe waste management system. The list of inventory should include the chemical identity, quantity, container type, waste code and waste generator [5]. This inventory will provide sufficient information about the type and amount of stored waste to organize the final pickup and disposal process.

4. Waste Removal Schedule

Chemical Wastes should be removed from each research laboratory in every 3-month at most. Hazardous waste stored in the Hazardous Waste Room (HWR) are disposed in every 6-months. The delivery of hazardous wastes is scheduled by Safety and Waste Management Team.

5. Storage of Chemical Wastes in the Hazardous Waste Room

The management of the Hazardous Waste Room (HWR) is under the responsibility of the Safety and Waste Management personnel.

a. The Chemical Waste Inventory Form (Annex 5) must be filled for each incoming waste container before storage.
b. The waste classification stipulated in laboratories is valid at Hazardous Waste Room.
c. Incoming wastes are transported in their own containers and placed in the relevant areas.
d. Hazardous wastes are stored on the basis of the essential conditions for incompatible chemicals (Annex 3).

6. Availability of Laboratory Waste Management Plan

This plan will be available for all faculty members and students at IESC web site. Students are responsible to read and understand the Laboratory Waste Management Plan before training seminar given at the beginning of academic semester.

References

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ANNEX 1. Chemical Hazard Symbols

Source: https://www.compoundchem.com/2015/05/19/hazard-symbols/ [8]

ANNEX 2. Examples of Chemicals with Identified Hazards

Symbol	*Official name*	*Meaning*	*Some examples you might find in schools*
	GHS01	EXPLOSIVE	Tollen's Reagent (ammoniacal silver nitrate) if allowed to stand.
	GHS02	FLAMMABLE	Zinc and aluminium dust, hydrogen, ethanol, methanol, propanone, sodium.
	GHS03	OXIDISING	Potassium manganate(VII) solid, ammonium nitrate solid, oxygen gas, nitrogen monoxide/dioxide, chlorine.
	GHS04	GAS UNDER PRESSURE	Hydrogen, oxygen.
	GHS05	CORROSIVE	Concentrated acids, some dilute acids (depending on concentration), concentrated alkalies, some dilute alkalies (depending on the concentration), sulfur dioxide gas, nitrogen monoxide/dioxide, sodium.
	GHS06	(ACUTELY) TOXIC	Solid barium chloride, most mercury compounds, sulfur dioxide gas, nitrogen monoxide/dioxide, chlorine, methanol.
	GHS07	MODERATE HAZARD (eg, harmful if inhaled or in contact with skin, causes eye irritation)	Some dilute acids or alkalies (depending on concentration), iodine solid and concentrated solutions, propanone.
	GHS08	HEALTH HAZARD (eg, sensitisers, carcinogens)	Most lead compounds and their solutions, most chromates and dichromates, dichloromethane, methanol.
	GHS09	ENVIRONMENTAL HAZARD	Most copper, mercury and lead compounds, and chromates and dichromates.

Source: http://science.cleapss.org.uk/Resource/SSS091a-Safety-signs-and-symbol-letters.pdf [9]

ANNEX 3. Common Laboratory Chemicals that should NOT be Stored Together

Chemical(s)	Never Store With or Around
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetic anhydride	Hydroxyl-containing compounds such as ethylene glycol, perchloric acid
Acetone	Concentrated nitric and sulfuric acid mixtures, hydrogen peroxide
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Alkali and alkaline earth metals such as powdered magnesium, sodium, potassium	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury, halogens, calcium hypochlorite, hydrofluoric acid
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids, heavy metals and their salts, oxidizing agents
Calcium oxide	Water
Carbon, activated	All oxidizing agents, calcium hypochlorite
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible material
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Chromic acid and chromium trioxide	Acetic acid, alcohol, camphor, glycerol, naphthalene, flammable liquids in general
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens, other oxidizing agents
Fluorine	All other chemicals
Hydrides	Water
Hydrocarbons (e.g., butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, peroxides
Hydrocyanic acid	Nitric acid, alkalis
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, any flammable liquid (i.e., alcohols, acetone), combustible materials, aniline, nitromethane
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon

ANNEX 3. Cont.

Chemical(s)	Never Store With or Around
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Metal hydrides	Acids, water
Nitrates	Acids
Nitric acid (concentrated)	Acetic acid, acetone, alcohol, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Mercury and silver and their salts
Oxygen	Oils, grease, hydrogen; flammable liquids, solids, or gases
Perchloric acid	Acetic anhydride, alcohol, bismuth, paper, wood, grease, oils
Permanganates	Concentrated sulfuric acid, glycerol, ethylene glycol, benzaldehyde
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus, white	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids, ammonium salts, metal powders, sulfur, finely divided organics, combustibles
Potassium perchlorate (see also chlorates)	Sulfuric and other acids
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Silver and silver salts	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, other chlorinated hydrocarbons, water
Sodium nitrate	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Chlorates, perchlorates, permanganates

Source:
https://www.uab.edu/ehs/images/docs/chem/CommonLabChemicalsThatShouldNOTBeStoredTogether.pdf [10]

APPENDIX 4. WASTE LABEL

FULL CHEMICAL NAME & Waste Code	Estimated Percentage, %	Mass (mg) or Volume (mL)
MATERIAL IDENTIFICATION	☐ Liquid ☐ Solid ☐ Gas Producing ☐ Peroxide Forming ☐ Used ☐ Pure Product ☐ Mixture ☐ Acid ☐ Alkaline ☐ Organic ☐ Heavy Metal ☐ Mercury ☐ Oil ☐ Others	
HAZARD IDENTIFICATION	☐ Flammable ☐ Toxic ☐ Oxidizer ☐ Corrosive ☐ Water Reactive ☐ Others (explain).....	
ACCUMULATION START DATE		
LOCATION AND GENERATOR		
DATE OF TRANSFER TO HWR		

ANNEX 5. HAZARDOUS WASTE INVENTORY FORM

Code	Waste Name/ Composition	Amount	Container Type/ Piece	Generator	Date	Name/ Sign