



# A safety and chemical disposal guideline for Minilab users

2020

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## INTRODUCTION

Tuebingen / Nairobi, November 2020

Dear partners of Difaem and EPN,

Working with and disposing of chemicals can pose risks if not properly conducted. Since the safety of our partners and especially Minilab network members is of utmost importance to us, we have prepared this safety and chemical waste disposal guideline for you. Its aim is to provide the best possible safety practice in a resource-limited setting. Our Minilab partners should adopt the guideline and adapt it to their respective local context. It should preferably be printed and therefore physically present in the laboratory.

Attached you will find Safety data sheets (SDS) of the individual Minilab chemicals. SDSs are standardized documents that list information relating to work safety and health in the use of chemicals. They also include instructions for the safe use and potential hazards associated with a particular material or product, along with spill-handling procedures and shall serve as an additional comprehensive source of information.

This guideline was carefully prepared by the pharmaceutical team of Difaem in collaboration with EPN. However, please note that neither Difaem nor EPN will take any liability for the content presented in this guideline. The document is not (legally) binding but shall serve as an orientation and practical guide for our partners especially in resource limited settings. All users are advised to adhere to their local/national rules and legislation concerning work safety, usage of chemicals and waste disposal.

A special thanks goes to our Difaem colleague and Intern Pharmacist Mr. Robin Schreiber, who invested a lot of time and efforts in collecting and compiling this guideline – always enthusiastic.

Furthermore, we highly appreciate the expert support of Dr. Roswitha Meyer. The material and expertise she provided were essential for creating this guideline and increased the quality of the information critically.



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## A: LABORATORY SAFETY GUIDELINE

### 1. Areas of application:

This safety guideline is applicable to all laboratory rooms in which the Minilab is used. All Minilab users must be familiar with the guideline. New workers must be instructed by their supervisor.

### 2. Responsibility:

The head of the institution is responsible for the safety of the staff working in the laboratory. Safety has to be ensured by appropriate measures and practices.

The head of the institution may instruct suitable persons in writing and with a clearly defined scope of agreed duties to be carried out on their own responsibility (e.g. the lab manager).

The employees using the Minilab need to be instructed and trained by the supervisor (e.g. head of the institution or instructed lab manager) prior to taking up work. Employees must sign to confirm that they were instructed and trained by the supervisor and understood the instructions. Once trained, the employees are jointly responsible for the use of the Minilab, the use of provided safety equipment and hence safety.

### 3. Accidents:

In case of an accident, first aid should be administered immediately and, if necessary, the emergency doctor called. In case of accidental exposure to a chemical, also see section 4 of the Safety data sheet of the respective substance for appropriate first aid measures.

The following person(s) must be notified:

\_\_\_\_\_ (supervisor) (tel.: \_\_\_\_\_)

### 4. Emergency telephone numbers (please fill in):

Fire department: \_\_\_\_\_

Emergency doctor: \_\_\_\_\_

Responsible head of the institution or lab manager: \_\_\_\_\_

### 5. Safety equipment (cross out if unavailable):

First aid boxes: position \_\_\_\_\_

Eye wash: position \_\_\_\_\_

Fume cabinets: position \_\_\_\_\_

Fire blankets: position \_\_\_\_\_

Emergency showers: position \_\_\_\_\_

Fire extinguishers: position \_\_\_\_\_

All laboratory users must make themselves familiar with the locations and the operation of the safety equipment before beginning work.

## 6. Visitors in the laboratory:

Visitors are NOT allowed in the laboratory rooms since no liability exists for persons not employed by the institute. Conducting teachings or trainings in the laboratory rooms is possible after a safety briefing of trainees and students.

## 7. Personal protection:

**Important:** Pregnant or breastfeeding women are prohibited from entering the laboratory at any time due to possible dangers to the child!

### a. Eye protection

**Safety glasses** should always be worn in the laboratory.

Preferably, use safety glasses with side shields. They provide protection from chemical splashes that might injure your eyes.



### b. Respiratory protection

**Masks (e.g. surgical)** should always be worn in the laboratory. Alternatively, fume cabinets can be used.

Though masks do not prevent from vapor, they prevent from breathing in droplets, aerosols, and dust as well as from chemical splashes entering the mouth.



### c. Physical protection

**Laboratory coats** and **gloves** should always be worn in the laboratory.

Laboratory clothing must be made of a material that will not melt when heat is applied (e.g. cotton). Closed, long-sleeved, high-necked gowns, made of solid material are to be worn for skin protection. Contaminated items of clothing must immediately be taken off and aired.

Laboratory gloves (Nitrile or Latex) provide protection from skin hazards. Gloves should be checked for cracks and holes before putting them on and regularly while wearing them. Keep in mind that chemicals can cause bad burns and lead to poor-healing wounds.



### d. Other

Do NOT use sandals and short trousers or skirts. Legs and feet must be covered for their protection, too. It is recommended to wear closed non-slip shoes.

## 8. Fire protection:

On the outbreak of fire, the supply of gas, electricity and air should be cut off immediately. Smaller fires may be suffocated by blanketing with a wet towel.

Larger fires should be fought using fire extinguishers. Foam fire extinguishers are preferred, but however, if not available others may be used, too.

Burning clothes may be extinguished with the help of the emergency showers, or better, by using a fire blanket thrown over the person (and if required by rolling the person on the floor).

Keep your own safety in mind: Burning chemicals may explode or generate toxic gases.

## 9. Supply connections (gas, water, electricity):

All laboratory users are required to familiarize themselves with the mechanisms to turn off gas, water and electricity.

Ideally, the laboratory should be equipped with an exclusive electrical protection circuit/fuse to facilitate switching off in case of fire.

Main power off:            position \_\_\_\_\_

Main water off:            position \_\_\_\_\_

Main gas off:                position \_\_\_\_\_

## 10. Ventilation of laboratory rooms:

If fume cabinets are unavailable, Minilab work shall be carried out after shock-ventilating the lab rooms by opening the windows before starting the Minilab work and after finishing the Minilab work in order to reduce the chemical vapours.

## 11. Storage and labelling:

All containers and bottles in which chemicals are stored must be clearly, correctly and durably labelled. They should be unbreakable, placed on a stable shelf and must not be above shoulder height. Storage of chemicals in corridors, stairways or hallways is forbidden.

Keep containers tightly closed in a dry and well-ventilated place.

Containers, which have been opened must be resealed carefully and kept upright to prevent leakage. Store in a cool place and protect from direct sunlight.

The sections "B: CORRECT LABELLING OF BOTTLES AND CONTAINERS" and "C: STORAGE OF MINILAB CHEMICALS" provide additional information about the labelling and storage.

Please find further information there.

## 12. Behaviour in work areas:

Laboratory rooms are work rooms and not common rooms. People are not permitted to stay in the laboratories, if they do not work there.

Each user is responsible for the cleanliness and orderliness of the laboratory.

Individual access to a work area does not rule out the possibility that others may be using the same work area at the same time. In this case, mutual consideration, restriction to the necessary workspace and observation of cleanliness and orderliness are especially important.

Prior to the use of equipment, it is absolutely necessary that the appropriate operating instructions are understood, or introductory guidance obtained. Damaged or defective equipment should no longer be used and be reported to the supervisor immediately.

After the completion of work, the work area and apparatus should be cleaned and the chemicals used must be returned to the chemical cabinet.

Before leaving the laboratory room, gas and water taps should be shut off, electronic equipment other than those that run continuously (e.g. drying cabinets, refrigerators and freezers) must be turned off, the lights switched off and the laboratory locked.

Disposal of chemical waste resulting from work should be carried out by the user, according to the regulations. Section "E: DISPOSAL" provides further information for the proper collection and handling of chemical waste.

Questions should be directed to the head of the institution or the lab manager.

## 13. Pipetting by mouth must be avoided completely:

Pipette balls or pumps must be used, when dispensing liquid.

## 14. Working with flammable materials:

These Minilab chemicals are flammable:

**Acetic acid, Acetone, 1-Butanol, Ethyl acetate, Methanol, Toluene.**










The heating of flammable materials without constant supervision is totally forbidden.

When working with flammable material in thin walled containers, they must be protected against breakage and while carrying them placed in safety basins filled with non-burnable adsorption material, e.g. dry sand, and large enough to absorb the complete contents of the containers.

The section "C: STORAGE OF MINILAB CHEMICALS" provides additional information.

## B: CORRECT LABELLING OF BOTTLES AND CONTAINERS

### Hazard symbols and their meaning:

<p><b>Health hazard</b></p> <ul style="list-style-type: none"> <li>- Carcinogen</li> <li>- Mutagenicity</li> <li>- Reproductive Toxicity</li> <li>- Respiratory Sensitizer</li> <li>- Target Organ Toxicity</li> <li>- Aspiration Toxicity</li> </ul> 	<p><b>Flame</b></p> <ul style="list-style-type: none"> <li>- Flammables</li> <li>- Pyrophores</li> <li>- Self-Heating</li> <li>- Emits Flammable Gas</li> <li>- Self-Reactives</li> <li>- Organic Peroxides</li> </ul> 	<p><b>Exclamation Mark</b></p> <ul style="list-style-type: none"> <li>- Irritant (skin and eye)</li> <li>- Skin Sensitizer</li> <li>- Acute-Toxicity (harmful)</li> <li>- Narcotic Effects</li> <li>- Respiratory Tract Irritant</li> <li>- Hazardous to Ozone Layer</li> </ul> 
<p><b>Gas Cylinder</b></p> <ul style="list-style-type: none"> <li>- Gases Under Pressure</li> </ul> 	<p><b>Corrosion</b></p> <ul style="list-style-type: none"> <li>- Skin Corrosion/Burns</li> <li>- Eye Damage</li> <li>- Corrosive to Metals</li> </ul> 	<p><b>Exploding Bomb</b></p> <ul style="list-style-type: none"> <li>- Explosives</li> <li>- Self-Reactives</li> <li>- Organic Peroxides</li> </ul> 
<p><b>Flame Over Circle</b></p> <ul style="list-style-type: none"> <li>- Oxidizers</li> </ul> 	<p><b>Environment (Non-Mandatory)</b></p> <ul style="list-style-type: none"> <li>- Aquatic Toxicity</li> </ul> 	<p><b>Skull and Crossbones</b></p> <ul style="list-style-type: none"> <li>- Acute Toxicity (fatal or toxic)</li> </ul> 

### Labelling correctly:

Original containers, which are delivered together with the Minilab, already meet all regulations for correct labelling.

**Important:** When reusing containers that previously contained other substances and were therefore already labelled, you must carefully clean the container, blacken the old label or remove it completely and replace it with a new one that describes the new substance(s). Two different labels on one container declaring different contents are unacceptable!

It is mandatory that the label contains the following information:

- Name of the ingredients (drawn chemical structures do not replace the name of the ingredient)
- In mixtures the names of all ingredients and their proportions
- Hazard symbol consistent with the correct classification of the chemicals contained (found in the Safety Data Sheet or on the original bottle of the chemical)
- An expiry date, if applicable

Please find further information concerning labelling in Point "11. Storage and labelling" of Section "A: LABORATORY SAFETY GUIDELINE".



## C: STORAGE OF MINILAB CHEMICALS

Acids, bases and organic solvents should be stored respectively separated from each other to prevent chemical reactions in case of leakage. This separation can be achieved by placing the chemicals in collection trays with a minimum height of 20cm.

Tray 1: Acids - this tray must be made of **plastic**

→ Place Acetic acid, Hydrochloric acid and Sulphuric acid in this tray.

Tray 2: Bases - this tray must be made of **plastic**

→ Place Ammonia solution in this tray.

Tray 3: Organic solvents - this tray must be made of **metal**

→ Place Acetone, 1-Butanol, Ethyl acetate, Methanol and Toluene in this tray.

The solid substances Ninhydrin, Iodine, Magnesium chloride and Sodium Chloride can be stored without a collection tray.

### Storage of stocks and larger amounts of chemicals:

Laboratory rooms should not be used as storage rooms for chemicals stocks. The average amount of chemicals needed in one week (max. 1L of each chemical) can be kept at the Minilab workplace. Stocks and larger quantities should be kept separately in a chemical storage room (separately from medicine stock). Large amounts of chemicals in a laboratory pose a risk to all employees.

Only if special security cabinets, designed for the storage of chemicals, are used for storage, larger quantities of chemicals may be kept in the laboratory (inside the security cabinet).

(Security cabinet position: \_\_\_\_\_)

### Special storage precautions for flammable materials:

The following substances in the Minilab are flammable:

**Acetic acid, Acetone, 1-Butanol, Ethyl acetate, Methanol, Toluene.**

Any flammable compound must not be stored in a fridge!

Please find further information concerning storage and safety in Point “11. Storage and labelling” and “14. Working with flammable materials” of Section “A: LABORATORY SAFETY GUIDELINE”.

## D: TRANSPORT OF CHEMICALS

When transporting containers containing chemical substances, make sure that they are completely sealed to prevent leakage. Avoid overheating which could lead to ignition or explosion (e.g. by parking the car in the shade). Put the containers in a position where they cannot fall or break at any time.

Keep the bottles and containers in collecting trays for transport. The trays for storing acids or bases have to be made of plastic, for storing organic solvents use metal trays.  
(The section “C: STORAGE OF MINILAB CHEMICALS” includes more details.)

Do not transport the chemicals in your private car. Try to find a licensed chemical transporter or ask a chemical supplier to transport your goods.

## E: DISPOSAL

Working with waste means taking on responsibility.  
The producer of waste is responsible for its final disposal.

The following section provides an overview of chemical disposal. However, this does NOT replace reading and following the safety instruction for each individual substance you work with.

**In case of doubt, you may always contact [gnegel@difaem.de](mailto:gnegel@difaem.de), [haefele@difaem.de](mailto:haefele@difaem.de) or [richard.neci@epnetwork.org](mailto:richard.neci@epnetwork.org).**

### Disposing correctly:

**1<sup>st</sup> choice:** The first choice for disposal is always to return chemical waste to a licensed disposal company. Contact the supplier of chemicals or any research/bigger laboratory (e.g. university, governmental or private laboratories) to inquire the availability of a disposal service. This service may incur cost.

**2<sup>nd</sup> choice:** If the above-mentioned disposal option is not feasible, you can contact a nearby cement factory: Furnaces used for the production of cement are designed and operated so that the parameters required for the destruction of chemical waste (including hazardous chemicals) are achieved. In many countries, cement companies are officially licensed to perform the destruction of certain hazardous wastes.

However, ask your regional authority, if disposing your chemicals in cement factory furnaces is permitted, before contacting the factories. Cement factories may want to have a list with the chemicals to dispose of before deciding on the acceptance of your chemical waste delivery.

**3<sup>rd</sup> choice:** If there are NO OTHER options available, you may dilute your chemicals of the water hazard class (WHC) 1, 1:10; and WHC 2, 1:100 with water and dispose of in the sewage. Mixtures receive the WHC classification of the ingredients from the highest class (e.g., a mixture with compound A (WHC 1) and B (WHC 2) receives WHC 2).

Table 1 informs you about the water hazard classes of the Minilab chemicals. (See next page.)

### Additional Information:

- The complete usage of chemicals prevents the production of waste.
- You may reuse residues of chemicals for other purposes, if the safety of the persons in contact with the substances is ensured and the substances are used correctly for each purpose. (E.g. Acetic acid for cleaning sanitary facilities or methanol for cleaning vessels and laboratory glassware.)

### Water hazard class (WHC):

Water body protection is vital for securing public health and the natural foundations of life, and as a prerequisite for economic development. To this end, water bodies must be safeguarded as an integral part of the natural environment and a habitat for animals and plants. Their management must benefit both the general public and, where the two can be harmonised, the interests of individuals, and avoid impairing their ecological functions.

The Water hazard class (WHC) is a substance specific classification to categorize the hazardousness to water. It is divided into the following classes:

- Not hazardous to water
- WHC 1: Slightly hazardous to water
- WHC 2: Clearly hazardous to water
- WHC 3: Strongly hazardous to water

Table 1: Chemical categories and water hazard classification of the chemicals used in the Minilab:

<b>Chemicals used in Minilab</b>	<b>Chemical category</b>	<b>Water hazard class (WHC)</b>
Acetic acid	Acid	WHC 1
Acetone	Organic solvent	WHC 1
Ammonia solution	Base	WHC 2
Ethyl acetate	Organic solvent	WHC 1
Iodine	Inorganic solid substance	WHC 2
Magnesium chloride	Inorganic solid substance	WHC 1
Methanol	Organic solvent	WHC 2
Sodium chloride	Inorganic solid substance	WHC 1
1-Butanol (=n-Butanol)	Organic solvent	WHC 1
Ninhydrin	Organic solid substance	WHC 1
Hydrochloric acid	Acid	WHC 1
Sulphuric acid	Acid	WHC 1
Toluene	Organic solvent	WHC 2

### Collecting waste for disposal:

Before making use of a licensed disposal service (recommended as 1<sup>st</sup> choice), contact the service provider to inquire about his requirements and preferences for collection and separation of chemical waste.

If not agreed differently, the chemical waste can be stored as mixtures in containers or bottles taking account of the information in section "Storage of substances".

Sort the waste into the group solid, aqueous and organic waste:

- **Solid waste:**

Minilab chemicals categorized as “inorganic solid substance” or “organic solid substance” in table 1, pure or as mixtures of solids only.

- **Aqueous waste** (Acids, bases and neutral):

Minilab chemicals categorized as “acid” or “base” in table 1, pure or as mixtures containing nothing but acids, bases, water and solid substances.

Try to neutralize the pH value. Do not add water to acid but slowly add acid to water. Otherwise, if water is added to acid, the liquids heat up very fast.

- **Organic waste:**

Minilab chemicals categorized as “organic solvents” in table 1, pure or as mixtures with any other Minilab chemical.

Try to neutralize the pH value.

## F: DANGEROUS REACTIONS, WHEN MIXING

Chemical	Mixed with:
Acetic acid	- Concentrated Sulphuric acid: Explosive - Ammonia solution 25%: Violent reaction - Water: <b>Mixture heats up very fast, when adding water to acid!</b>
Acetone	- Sulphuric acid: Risk of ignition
Ammonia solution 25%	- Iodine: Explosion hazard
1-Butanol	- Concentrated Sulphuric acid: Mixture heats up
Ethyl acetate	- Hydrochloric acid: Violent reaction - Concentrated Sulphuric acid: Violent reaction - Ammonia solution: Violent reaction
Hydrochloric acid	- Concentrated Sulphuric acid: Explosives - Water: <b>Mixture heats up very fast, when adding water to acid!</b>
Iodine	- Ammonia solution 25%: Explosion hazard
Magnesium chloride	- Concentrated Sulphuric acid: Mixture heats up
Methanol	- Concentrated Sulphuric acid: Mixture heats up
Ninhydrin	- Concentrated Sulphuric acid: Mixture heats up - Hydrochloric acid: Mixture heats up
Sulphuric acid	- Acetic acid: Explosive - Hydrochloric acid: Explosive - Water: <b>Mixture heats up very fast, when adding water to acid!</b> - Acetone: Risk of ignition - 1-Butanol: Mixture heats up - Ethyl acetate: Violent reaction - Magnesium chloride : Mixture heats up - Methanol: Mixture heats up - Toluene: Mixture heats up
Toluene	- Concentrated Sulphuric acid: Mixture heats up

Herewith I declare with my sign, that I read and understood this safety guideline and I guarantee only best practices to ensure the maximum safety and protection for my employees and colleagues.

Date and city name,

\_\_\_\_\_

Signature of the head of the institution \_\_\_\_\_

Signature of the lab manager \_\_\_\_\_

Signatures of the trained employees

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

# APPENDIX 1: Sources

## Sources for Part A: LABORATORY SAFETY GUIDELINE

- Meyer, Roswitha (Physikalisch-Technische Bundesanstalt) (2018), Chemical Waste Management for Laboratories, 1<sup>st</sup> edition, Braunschweig, Germany.
- Deutsche Gesetzliche Unfallversicherung (DGUV) (Jedermann-Verlag GmbH) (2011), Working Safely in Laboratories – Basic Principles and Guidelines, 2<sup>nd</sup> Edition, Berlin, Germany.
- Safety data sheets according to Regulation (EG) No. 1907/2006 for each Minilab substance (Sigma-Aldrich Chemie GmbH), latest Versions, retrieved 18<sup>th</sup> August 2020, Taufkirchen, Germany.
- Safety data sheets according to Regulation (EG) No. 1907/2006 for each Minilab substance (Carl Roth GmbH & Co KG), last updated: 02.04.2020, retrieved 14<sup>th</sup> October 2020, Karlsruhe, Germany.

## Source for Part B: CORRECT LABELLING OF BOTTLES AND CONTAINERS

- Safety data sheets according to Regulation (EG) No. 1907/2006 for each Minilab substance (Sigma-Aldrich Chemie GmbH), latest Versions, retrieved 18<sup>th</sup> August 2020, Taufkirchen, Germany.

## Sources for Part C: STORAGE OF MINILAB CHEMICALS

- Safety data sheets according to Regulation (EG) No. 1907/2006 for each Minilab substance (Sigma-Aldrich Chemie GmbH), latest Versions, retrieved 18<sup>th</sup> August 2020, Taufkirchen, Germany.
- German Federal Ministry of Interior, Building and Community: Technische Regeln für Gefahrstoffe (TRGS) 510 (GMBI) (2015), last updated: 30.11.2015, retrieved 14<sup>th</sup> October 2020 from [https://www.baua.de/DE/Angebote/Rechtstexte-und-Technische-Regeln/Regelwerk/TRGS/pdf/TRGS-510.pdf?\\_\\_blob=publicationFile&v=2](https://www.baua.de/DE/Angebote/Rechtstexte-und-Technische-Regeln/Regelwerk/TRGS/pdf/TRGS-510.pdf?__blob=publicationFile&v=2).
- ChemSpider, retrieved on 14<sup>th</sup> October 2020 from <http://www.chemspider.com>.

## Sources for Part D: TRANSPORT OF CHEMICALS

- Safety data sheets according to Regulation (EG) No. 1907/2006 for each Minilab substance (Sigma-Aldrich Chemie GmbH), latest Versions, retrieved 18<sup>th</sup> August 2020, Taufkirchen, Germany.

## Sources for Part E: DISPOSAL

- Safety data sheets according to Regulation (EG) No. 1907/2006 for each Minilab substance (Sigma-Aldrich Chemie GmbH), latest Versions, retrieved 18<sup>th</sup> August 2020, Taufkirchen, Germany.
- The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. Information retrieved on 12<sup>th</sup> October 2020, from <https://www.bmu.de/en/topics/water-waste-soil/water-management/handling-of-substances-hazardous-to-water/>.
- Meyer, Roswitha (Physikalisch-Technische Bundesanstalt) (2018), Chemical Waste Management for Laboratories, 1<sup>st</sup> edition, Braunschweig, Germany.

## Source for Part F: DANGEROUS REACTIONS, WHEN MIXING

- Safety data sheets according to Regulation (EG) No. 1907/2006 for each Minilab substance (Sigma-Aldrich Chemie GmbH), latest Versions, retrieved 18<sup>th</sup> August 2020, Taufkirchen, Germany.

# APPENDIX 2:

## Safety data sheets of all Minilab substances

The attached Safety data sheets (SDS) are standardized documents, which provide important information about the Minilab substances relating to work safety and health in the use of chemicals, instructions for the safe use and potential hazards and is structured as follows:

1. Identification of the substance
2. Hazards identification
3. Information on ingredients
4. First aid measures
5. Firefighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/Personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information (Additional and detailed)

### Order of the contained safety data sheets:

- 1-Butanol
- Acetic acid
- Acetone
- Ammonia solution 25%
- Ethyl acetate
- Hydrochloric acid
- Iodine
- Magnesium chloride
- Methanol
- Ninhydrin
- Sodium chloride
- Sulfuric acid
- Toluene