

Behavior and first aid measures in the event of lab accidents

Where is the first aid kit?

On the wall, next to the fire extinguisher (on the side of the entrance door) is an orange FIRST AID BOX.

It contains plasters, bandages, etc.

Please help yourself if you are injured or if you have to be a first aider.

Please let me know if anything runs out so I can refill.

A small advice:

You can remove the box from the wall and carry it to the place where it is needed.

Verbandsbuch:

All injuries and accidents during the working hours or on the way to work are “work accidents” and should be recorded in an “accident book”. Please write down all injuries, even very small ones. Perhaps a harmless cut could develop to blood poisoning. “Work accidents” are treated differently regarding to the insurance.

The “accident book” is located in the safety cabinet, next to room 3H16.

It`s not really a book, it`s a writing pad.

Please, fill out the form and give it to me. I will keep it in a folder.

About lab-accidents

Most of you don`t work in the lab. However, you should know what to do in the event of a lab accident. Each of you could become a first aider if you work here in the computer lab and an accident happens here in the lab next door.

A typical lab accident is usually a contact with a chemical agent (e.g. on skin, in the eye, ingested or inhaled)

The following applies to all chemicals we work with. Except for Hydrofluoric acid, HF, which is very special, more about that later.

First of all, it should be said:

In all accidents with chemicals, whether acids, bases or other things, ACT AS QUICKLY AS POSSIBLE:

The more time the chemical can react on the skin or in the eye, the more damage is done.

TIME is a very important factor to prevent worse.

However, with all the time pressure, don't forget to protect yourself.

Depending on the situation, put on gloves, goggles, lab-cloth etc.

Safety equipment can be found in the cabinet, next to the room 3H16.

The safety equipment, stored in this cabinet, is only for first responders, not for lab work

How should we act?

In general, you can say, that you can't go wrong with "rinsing with water" as the first measure. On this way...

1. The chemical is removed from the skin or from the eye. So, the substance is washed away, and...
2. There is also a dilution effect.

Therefore, all labs are equipped with emergency showers and eye showers (with water, of course)

Where are the emergency showers?

There are showers in every lab. Right after the door is the shower, it's hanging from the ceiling. Just pull on the handle and the water come out of the shower in a flood.

When do I use the emergency shower?

When someone is doused with a large amount of chemical.

I give you an example:

A large container (2,5 L) conc. HCl breaks in my hand and it is poured over me.

The soaked clothing affects my skin.

In this case, the person must go under the emergency shower (with the clothes on) and undress under running water.

A shirt should not be pulled over the head (because of contamination of the head) but cut open with scissors. Scissors are also located in the safety cabinet, also in the first aid box.

Eye shower:

There is a small, recessed eye shower at each sink (only sinks in the labs). You can pull this out and rinse the eye with running water.

When do you use an eye shower?

If you get a chemical in your eye, use the eye shower to rinse and clean the eye with water.

But we do it in a different way, regarding to the eye shower and smaller amounts of chemical contact (the use of the emergency shower with large amounts remains):

As first aid for chemical accidents (contacts with chemicals), we use a special first aid kit from PREVOR, for both...skin and eye contact.

This agent is better than water. It neutralizes the pH and binds the chemicals. We can use it for all, really all chemicals we work with, except HF.

We use the PREVIN rinsing solution for both.

To rinse chemicals from the skin as well as from the eye. The bottle has a very practical shape to be placed on the eye.

When rinsing the eye (with the lid open of course), always make sure to rinse away from the eye and turn the head in that way, that the uninjured eye does not come into contact with the liquid (otherwise the chemical will also flow into the healthy eye.)

Use the whole content of the bottle to rinse the eye. After rinsing with PREVIN, you should bring back the eye in its physiological state, (for example the isotonia of the eye). To do this, use the AFTERWASH II bottle and rinse the eye in the same way as with the PREVIN solution in advance.

The AFTERWASH solution is only used for the eyes (after washing out with PREVIN –as the name already says AFTERWASH)

AFTERWASH is for nothing else...not for *afterwash* the skin.

What to do if Chemicals are spilled:

Do not wipe up spilled chemicals, use an absorbent first. Sprinkle the chemical with an absorbent binder. We use **CHEMIZORB** for this and this is available in every lab. Instructions for use are also written in English on the container.

You do the following:

Sprinkle the spilled agent with CHEMIZORB, wait a while, pick up in a bag and dispose of in the blue bin and wipe the area with water.

CHEMIZORB does not neutralize, it binds the substance...like cat litter. So, wear protective clothing.

The blue bin is located in the large fume hood in room 3H16. Hazardous special waste is collected in this blue bin.

Contaminated cleaning rags and gloves are also disposed of in this blue bin. (liquid items please collect in canisters)

CHEMIZORB is an all-round product and can be used for everything we work with (acid, bases, solvents, oil...)...except HF!

So, now we come to the famous hydrofluoric acid, chemical formula HF

HF is very toxic and already lethal in small quantities on contact.

3H16 and 3H18 are HF-labs. This means that HF is used (and worked with) in these rooms and HF is also stored there.

This also means that this is the greatest danger zone in the entire lab area.

That is the reason for these stickers on the door...

When we are working with HF or HF evaporates in the hood, we **put a sign on the door.**

So you are aware, that at the moment, there is a dangerous situation in that lab.

A sign is also attached when HF is evaporating in the hood.

In this case, nobody should enter the lab before you have taken a look through the window to see if the fume hood is working (green light is ok, red light means error - an acoustic signal also sounds).

In the event of "red light", you may only enter the lab with a gas mask.

(this only applies, if you have to go into the lab as a **first aider**...otherwise it's not your job to check the hoods.)

What makes HF so dangerous and what distinguishes it from other acids?

Like all other acids, HF has a H-Proton that is responsible for the corrosive effect. But HF also has a F-Ion and that F-Ion is the reason why this acid is so dangerous.

The special properties of HF are:

HF is lipophilic:

That's the reason why HF goes through the skin very quickly, there is no barrier (the skin is like a sponge for HF). The HF can go very deep (penetrates very deeply) and the corrosive H-Proton can even burn the bones and the Fluoride can spread throughout the body.

In contrast, other acids usually only cause local surface burns.

Why is the F-Ion such a big problem?

The F-ion has the property to combine with the body's own vital calcium. Ca- is an essential component of body cells, muscles (e.g. the heart) and organs. HF is absorbed through the skin, F-ions are distributed throughout the body (by the bloodstream) and combine with the body's own Ca- ions (also Mg-ions).

As a result, the body has no or less "free" Ca- and it can lead to fatal heart failure and/or organ failure. Even very small amounts of HF are sufficient for this.

Imagine:

7 ml conc. HF, through the skin, can bind the total Ca- of an adult man

In addition, HF is very insidious

The skin only shows typical acid burns (visible) in high HF concentrations. At lower concentrations, no or only minor burns may be visible on the skin. The burns are in the depth (remember the lipophilic property).

The insidious thing about this is:

You can't see anything, but something happens anyway

At low concentrations (e.g. 5%) the HF can react latently for a long time. Symptoms, like strong pain, can occur up to 2 or even 3 days after HF contact and the situation is still fatal.

This should also be taken into consideration, if a colleague is feeling bad without working with HF at the moment, but maybe 2 or 3 days before.

So, if you know that about HF, you will better understand the following first-aid-procedure:

Everything you do in the following as a first responder must happen as quickly as possible.

Only quick action can protect against long-term consequences or even death. It is best to do everything within the first minute after contact.

But the most important is first:

Protect yourself.

Do not touch a **“HF-person”** (person with HF) without protection.

If you come in contact with HF, you are the next person whose life is in danger.

Imagine:

A person has doused himself with HF and knows he is in a mortal danger and maybe in shock and run out of the lab, screaming for help...Attention: Don't touch that person.

First rule: Protect yourself. Put on safety clothing

Protective equipment for first aiders are in the safety-cabinet (next to 3H16). Everything is there what you could possibly need. Assess the situation and decide what you need.

The more you put something on, the more valuable time goes by...

e.g. rubber boots only in case of spilled HF on the floor (when there is a HF-puddle...)

(When I've got HF on my fingers you don't need rubber boots as a first aider).

mask in case of HF-vapors

- Lab coat
- Rubber apron
- Overcoats for arms
- Gloves

- Goggles and face protection
- Rubber boots or overcoats for feet/shoes
- Gas mask

A gas mask is only needed if either the hood failed while evaporating HF and therefore HF gas are to be expected in the room or a large amount of HF has been spilled on the floor. HF over 40% evaporates at room temperature. HF has a unmistakable pungent smell. That means, you definitively smell it.

Now, you are ready to provide first aid!

Hexafluorine HF-emergency-kit

In the event of an HF accident, we do not use water to dilute and rinse away the HF acid, instead we use HEXAFLUORINE from the **HF-Emergency-Kit**. This is available in every HF lab and also in the safety cabinet.

I will explain the kit:

Hexafluorine-Solution:

With this solution we rinse the HF away from the skin. That means instead of water we take this solution.

Hexafluorine is the gold standard and prevents acid damages and also damages caused by the Fluoride.

This solution neutralizes the pH and also binds the dangerous Fluoride, it forms chelates with F-ions.

In addition, Hexafluorine is hypertonic and works through osmotic pressure. That means, the penetration of HF into deep tissue is stopped by creating a backflow in the tissue from inside out. (that works through the “concentration gradient”)

What to do in case of an eye contact:

The Hexafluorine bottle is also an eyewash bottle, you can see it by the shape.

Hold the eye lid open (possibly with a 2nd helper) and rinse the eye with the entire content of the bottle, if necessary also take the 2nd bottle. Make sure that the uninjured eye is protected from the rinsing process.

Hexafluorine is not a physiological solution, so you should rinse with **AFTERWASH II** afterwards (as I already explained with the PREVIN solution).

This is to bring the eye back to physiological balance.

Afterwash-solution is used only *after eye rinsing*, not *after skin rinsing*.

Ca-Gluconat-Gel:

This is for the skin.

You remember the problem? The Fluoride binds the Ca-? That`s why we add Ca to the body with a Ca-gel!

After rinsing with Hexafluorine, rub the skin with that Ca-gel.

After several minutes, rinse off the gel with Hexafluorine, apply new Ca-gel and continue rubbing in.

Repeat the process over and over again, till the emergency doctor comes.

Frubiase Trinkampullen:

For any kind of HF contact (whether skin or eye contact, inhalation or ingestion), take 2 ampoules. This is a Calcium-drink and can bind the Fluoride and/or give Ca back to your body.

How does it work?

(There is a small cup in every HF-emergency-kit, that`s for the Frubiase).

Break off the glass ampoule at the mark. Don`t worry, you can`t injure yourself on this glass.

If you only break one side, the liquid cannot flow out. You have to break open the other side too. Now pour into the cup and drink.

Cortisone Spray:

In case of inhaling HF, 8 puffs of a cortisone aerosol should be inhaled.

It works like this:

load the inhaler....breath in.....load...breath in...

Cortisone is supposed to prevent a development of pulmonary edema.

Brief instruction: Aushang

Because you will forget this all, we placed a short instruction on the lab doors and at each HF emergency station.

The emergency doctor must always be called, regardless of the type of HF contact (skin, inhaled...) or only suspected contact. The patient must be taken to the hospital, even if the patient is well (you remember the insidiousness of HF?...symptoms can appear days later)

It is better to do the emergency call from the wired telephone. Dial 112. There are also red stickers with the number on each telephone.

The emergency doctor often has no experience and no knowledge of the HF hazard.

The ambulance must be made aware of the seriousness of the situation. Put them under pressure to bring the patient immediately to the BG-Klinik (opposite of GUZ) or, if the eye is injured, to the eye-clinic. The patient can feel good and that can mislead the ambulance and maybe lose a lot of value time.

The majority of doctors do not know about HF, this happens very rarely and many doctors are not confronted with such a case for their entire professional life

HF-pass

Therefore, the emergency doctor must be given a **HF-pass** (located in a folder in the safety-cabinet) and he must give it to the doctor at the hospital.

The HF-pass says how the doctor should treat...what to do... the passes are personalized, so give over the right one.

The ambulance service and the clinic may not have the necessary medication in stock. Therefore, you should give the HF-emergency-kit (a complete set for the ambulance is stored in the safety-cabinet) to the rescue service so that the treatment in hospital can start immediately.

ca-gluconat-solution is the most important. It can be given intravenously in the clinic and/or by inhalation using a nebulizer.

Spilled HF

Chemizorb HF

Never wipe up spilled HF only with rags or water, use Chemizorb HF.

Use this binding and neutralizing agent. Sprinkle the HF with that, let react for a period of time, pack in a bag (self-protection!) and dispose of in the blue bin. After that, wipe with water...

Finally, I would like to show you this folder.

Betriebsanweisung (Operating Instructions)

Such a folder is found in every lab (in red: **lab safety**) and it contains “operating instructions” for every chemical that is stored in that lab and we are working with.

These instructions are also available in English.

Each chemical agent has its own instruction in which everything important is written. E.g. Properties, chemical reactions, behavior in case of danger, first aid measures....all that things we talked about

If you get into a situation in which you don't know what to do, take this folder and you will get the important information.