

A photograph of a chemical plant or refinery. The scene is dominated by a complex blue steel structure, likely a walkway or platform, with a wooden handrail. In the background, various industrial equipment, pipes, and tanks are visible. A worker wearing a yellow hard hat and a brown jacket is standing on the walkway to the left. The overall atmosphere is industrial and well-lit.

Safety @ P&E

Why is workplace safety important?



INJURY - Over 3 Million people were hurt on the job in 2014



DEATH - There were 4,679 workers killed on the job in 2014



FINANCIAL LOSS - Death & injury impact the company financially. Put safety first, reduce financial loss.



PROPERTY DAMAGE - Added financial impact occurs from workplace injury or death



WORKER PRODUCTIVITY - Implementing safety training & education creates a positive work environment.



IMPROVED QUALITY - When a company cares about it's employees, the employees care about their product



CORPORATE REPUTATION - Sales and perceived quality increase with a good reputation



“shocking death of a 23-year-old research assistant [...] received horrific burns in a UCLA lab fire”

“supervisor [...] may face a criminal trial”

“second lab death, at Yale University”

“bitten while extracting venom from rattlesnakes”

“being sprayed on the face and hands with sulphuric acid, leading to US\$3,000 of dermatology treatments”

“Only 60% said they had received safety training on specific hazards or agents [...]”

“40% of junior scientists said that people worked alone in their lab every day — compounding the risk to health should an accident occur — compared with just 26% of senior respondents”

“only 12% of younger scientists said that safety was “paramount, and takes precedence over all other lab priorities”, compared with 36% of senior scientists”

“Questionnaire suggests researchers not as safe as they feel”

“Some 86% of the roughly 2,400 scientists who responded said that they believe their labs are safe places to work. Yet just under **half had experienced injuries** [...]” (emphasis added)

“growing body of reports that point to the need to improve the culture around safety in our academic laboratories”

R. Van Noorden,
Nature 493 9-10,
2013

 TU Delft

Contents

- Personal Protective Equipment
- Alarms and evacuation
- General safety measures for chemical lab and frame
- Housekeeping

Personal Protective Equipment (PPE)



Personal Protective Equipment



Personal Protective Equipment



Personal Protective Equipment



Alarms and evacuation



Gas alarm of a setup

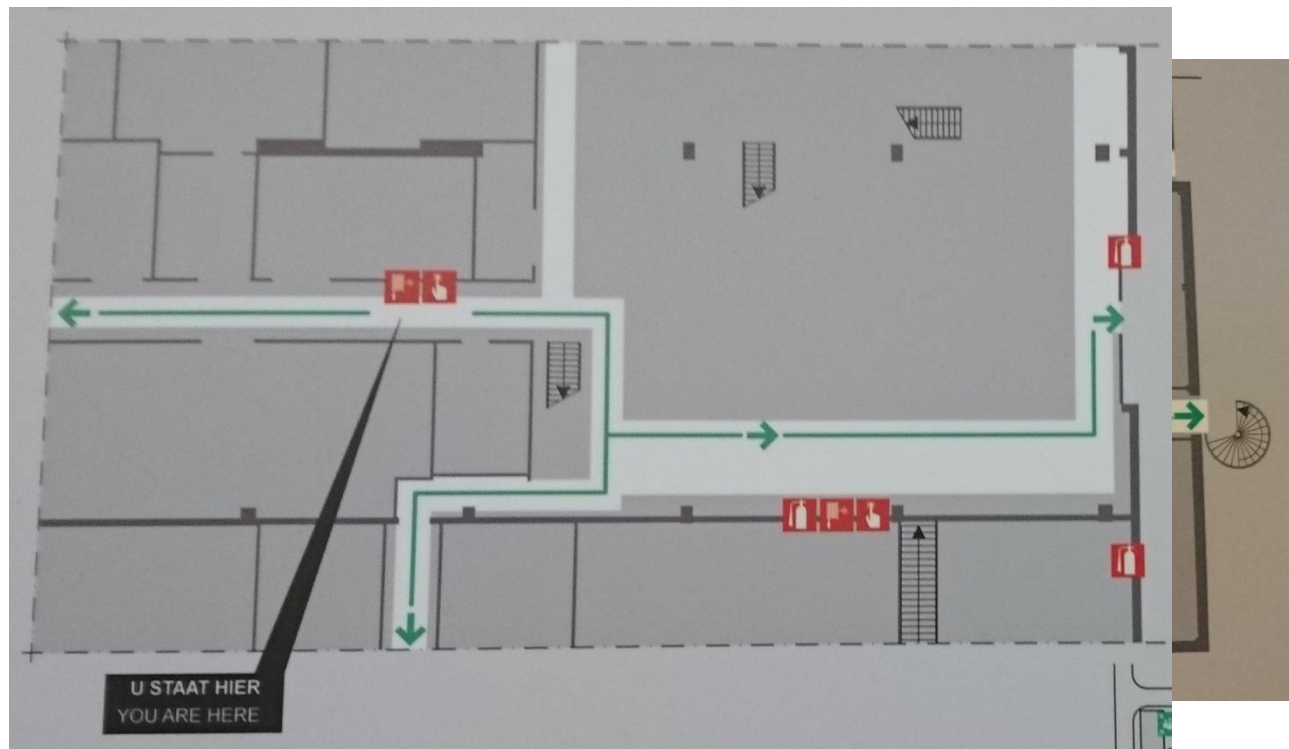


Evacuation alarm

Alarms and evacuation



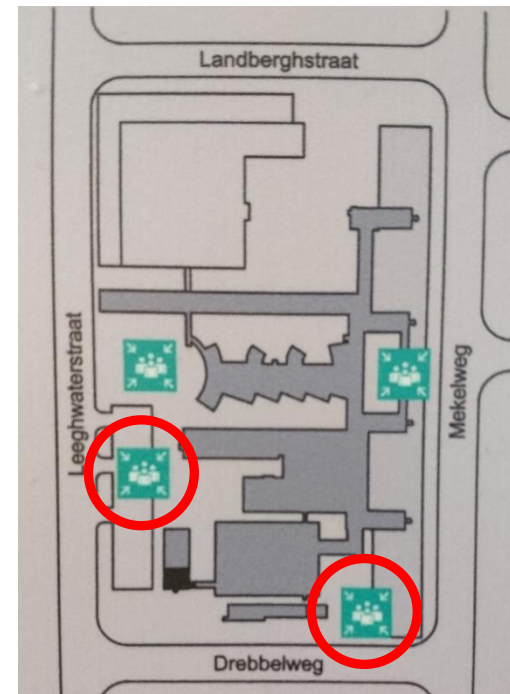
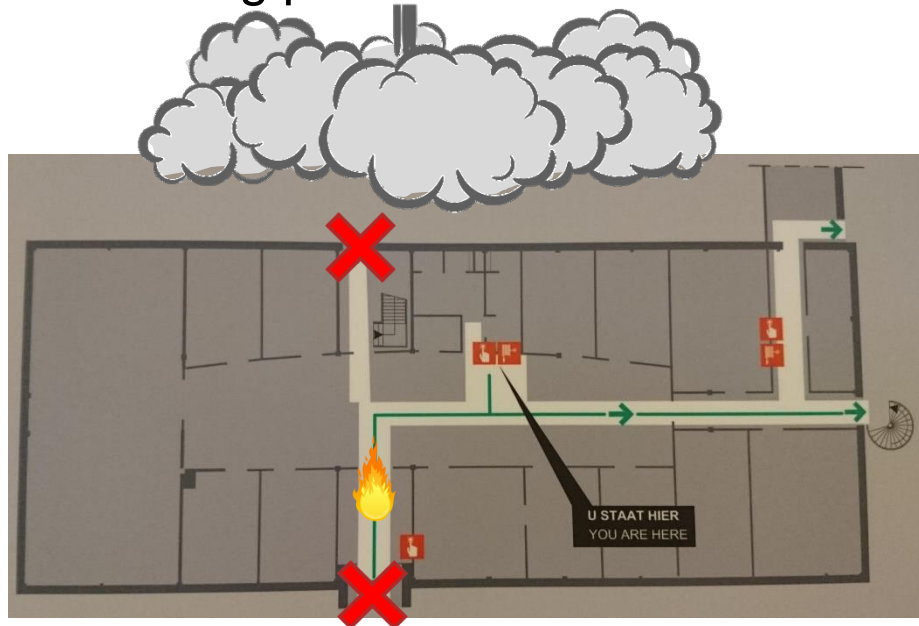
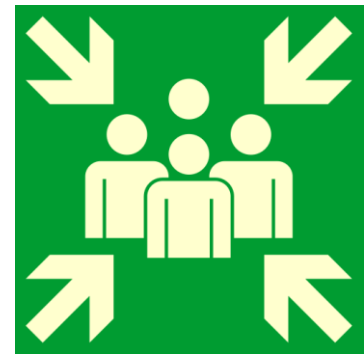
- Be **aware** of how your actions can affect your surroundings
- Be **aware** of how your surroundings can affect you
- **Always** know at least 2 exits from the area you are in
(in various places you find information notices)



Alarms and evacuation

- What to do in case of **evacuation alarm**:

- When evacuating, don't pack your stuff! But immediately move towards an exit
- Only use exits that lead away from the calamity
- Meet at the Meeting Point (and not near the door!): safety officers need to check for missing persons



Safety measures in the chemistry lab

- Label samples properly:
 - Compound, concentration, date, name/initials



Safety measures in the chemistry lab

- You need more of that stuff, so you fill up the beaker a bit more using poorly labelled samples



Safety measures in the chemistry lab

- Be sure everyone next to you (even if not working with chemicals) is wearing safety glasses



Safety measures in the chemistry lab

- Wear safety glasses also if you wear normal glasses (various models available and prescription safety glasses can be ordered)
- Never wear contact lenses
- Cover your arms, legs and feet (consider a separate set of clothing only for the lab)
- Wear a lab coat: it can be removed quickly when splashed with chemicals
- Wear gloves and change them regularly. When you leave the lab, remove gloves and wash your hands
- Avoid contaminating surfaces and objects
- Know the Material Safety Data Sheet (MSDS) of all chemicals you are working with
- Label samples properly

Safety measures in the frame

- Leave your normal coat and bag on the corridor, you can use a locker
- ALWAYS helmet, safety glasses
- ALWAYS foot protection except when the lab manager gives exemption (e.g., for lab tour)
- All PPE (Personal Protective Equipment) is available near the frame
- ALWAYS cover your legs
- Lab coat when working with chemicals
- NEVER leave the frame with your gloves on
- Wash your hands after leaving the frame

Safe behaviours and Housekeeping



- Any surface and object can potentially be contaminated with unknown and harmful chemicals. By touching food and/or eating/drinking you may ingest them!
- Even food in a bag can become inadvertently contaminated.
- There is only one place for food that has been in a chemical lab, and that is in the waste bin.



Safe behaviours and Housekeeping

- Do not let unauthorized people into laboratories; do not enter laboratories without permission
- You need to pass a safety course in order to get permission to enter laboratory areas

<http://labsafetyworkspace.org/> (Introduction to laboratory safety)

Hand in your certificate to lab manager


- Office hours Mon-Fri 08:00-18:00
- Off-working hours rule: permission in order to work in lab areas from Rob in advance!
 - MAXIMUM 2 weeks per permission!
- DO NOT WORK ALONE, always bring a buddy

Safe behaviours and Housekeeping

- Mechanical work inside the enclosure of setups (or at least the parts that are controlled by gas detectors*) can be done by researchers themselves. **But** ask technicians to check it when finished!
- Outside the enclosure, only DEMO technicians are allowed to make changes.
- Students are not allowed to do electrical work on setups. Ask our technicians for this
- Don't couple multiple power strips, or connect too many equipment power socket. This will cause, at least, fuse break !

Safe be

- All setu
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- All setu











		Delft University of Technology Faculty of Applied Sciences Chemical Engineering department		ChemE	
"Safety Assessment Sheet"					
Author:		Debby Den Besten		phone TU -	
(WeiWei Li)		room # 34-K-1-100		private 0651282755	
Area Supervisor:		Michel van den Brink		phone TU 015-2787097	
		room # 34-1-0-860		private -	
Description of experiment:					
Synthesis of an isoindoline from benzoylbenzoicacid and isopropyl amine.					
In the first step 2-benzoylbenzoicacid will be dissolved in THF and will be treated with SOCl ₂ and DMF. This mixture will subsequently be stirred for 16 hours in an inert atmosphere (nitrogen flow).					
In the next step the excess of THF and SOCl ₂ will be evaporated in a rotary evaporator. The resulting oil will be dissolved in THF again and cooled in an ice bath. Next isopropyl amine and triethylamine will be added, which will react exothermically. The mixture will be stirred at room temperature for 5 hours.					
In the third part of the synthesis the organic layer will be separated from an aqueous layer by adding 1M HCl and EtOAc. The resulting organic layer will be washed with saturated aqueous NaHCO ₃ and water. In the last step the organic layer will be dried with Na ₂ SO ₄ and the solvent will be removed by rotary evaporation to give the product.					

ng

it Sheet

report

<https://www.tudelft.nl/en/3me/departments/process-energy/overige/links/>

Temperature (°C)		ambient		Pressure (bar)		ambient			
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Hazardous materials and solvents	Dangerous properties	MAC	Halogen rich/poor	Acid /base	Phase				
Tetrahydrofuran (THF)	Flammable	300 mg/m ³	-n/a-	n/a	Liquid				
Thionyl chloride (SOCl ₂)	Corrosive	1 mg/m ³	rich	acidic	Liquid				
Dimethylformamide (DMF)	Flammable	15 mg/m ³	-n/a-	n/a	Liquid				
Isopropyl amine	Flammable	12 mg/m ³	-n/a-	n/a	Liquid				

Double click to fill in grey areas – Hit F1 for info after selection – Add manually further data after printing to complete form

Safe behaviours and Housekeeping

- At all times, people must work in a safe and clean manner
- Know where the safety equipment is
- Dispose of waste in the appropriate manner



Safe behaviours and Housekeeping

- Inorganic acids in solution



Categorie I
Zure en neutrale anorganische afvalstoffen in oplossing

- Inorganic alkali in solution



Categorie II
Alkalische anorganische stoffen in oplossing

- Halogen poor organics



Categorie III
Halogeen arme organische stoffen

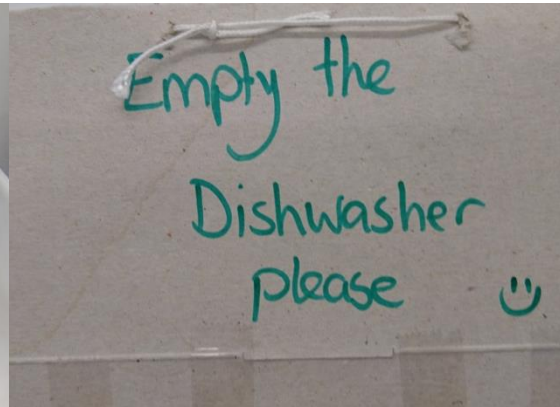
- Halogen rich organics



Categorie IV
Halogeenrijke organische stoffen

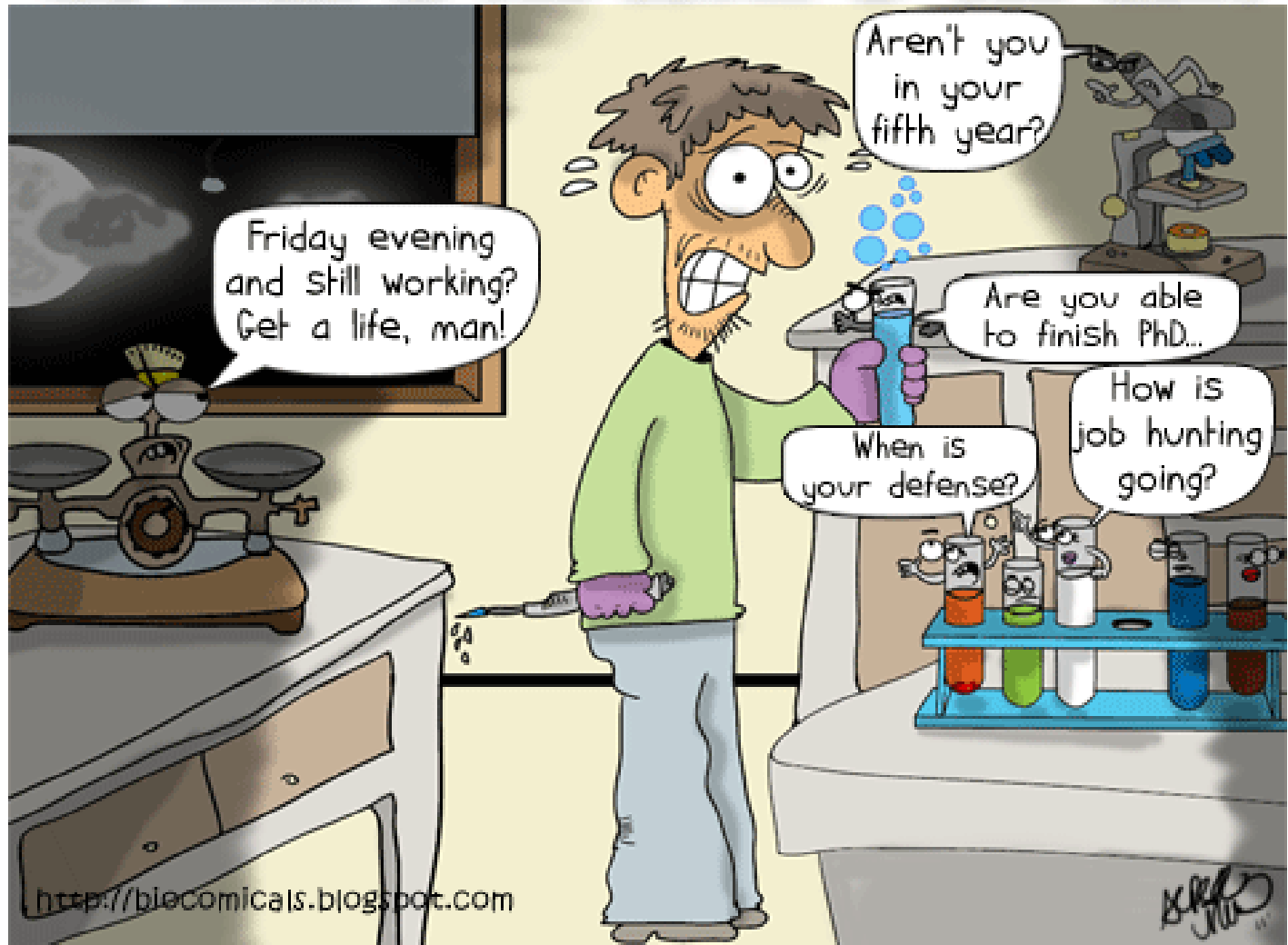
Safe behaviours and Housekeeping

- Clean your glassware and put them back in the cupboards
- Keep the lab operational:
 - Replace full waste containers
 - Replace empty spray bottles
 - Replace empty towel racks
 - Don't fill the dishwasher with dirty glassware before the clean glassware is taken out and put back in storage



Safe behaviours and Housekeeping

LAB ALONE IN THE MIDDLE OF THE NIGHT



Safe behaviours and Housekeeping



Don't leave your working area like this...

Safe behaviours and Housekeeping



...or the shelves like this!

Safe behaviours and Housekeeping



Don't throw chemical waste in the regular bin!

Safe behaviours and Housekeeping



Safe behaviours and Housekeeping

- Incidents @ P&E:
 - Isopropanol in the eye
 - Cleaner injured on needle in trash can
 - Deep cut in finger from glass in the sink
 - Near fall from height because a chair was used as a raised working platform
 - BBQed lab from leaking exhaust
 - BBQed lab due to ventilation failure
 - Broken nose from 'exploding' steam valve

(luckily, this one wore a **helmet**)

Things happen. We need to work together to keep ourselves and each other safe



Safe behaviours and Housekeeping

Have the right mentality:

- Look around you
- Try to identify unsafe situations and hazards
- If you see something unsafe, notify the person
- If you've got a question, ask
- TALK TO EACH OTHER
- Ultimately, it is not about rules and punishment, it is about *collaborating to create a safe work environment*
- Sanctions may be imposed though



Thank you