NTNU
Norwegian University of
Science and Technology

NTNU NanoLab

Chemical Introduction Course

By Trine Ø. Hjertås

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Working with chemicals

- It is your duty to examine whether the substances are hazardous in any way.
- Read the Safety Data Sheet (SDS)
- Always work with, and store hazardous chemicals in ventilated areas.

SIGMA-ALDRICH

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006
Version 5.5 Revision Date 01.03.2012
Print Date 05.03.2012

GENERIC EU MSDS - NO COUNTRY SPECIFIC DATA - NO OEL DATA

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product identifiers

Product name : Hydrochloric acid, 37%

Product Number : 320331
Brand : Sigma-Aldrich
Index-No. : 017-002-01-X
CAS-No. : 7647-01-0

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Norway AS
Tevlingvn. 23
N-1081 OSLO

Telephone : +47 23 176000
Fax : +47 23 176010
E-mail address : eurtechserv@sial.com

1.4 Emergency telephone number

Emergency Phone # : Giftinformasjonssentralen 22 59 13 00

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

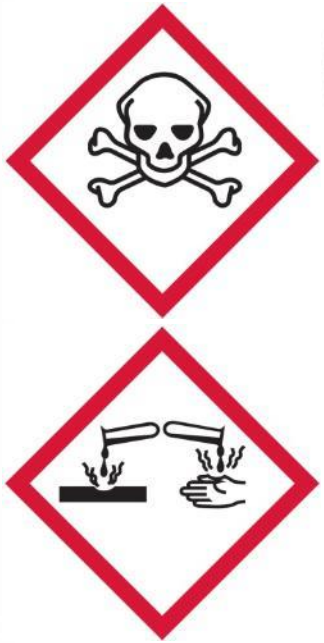
Classification according to Regulation (EC) No 1272/2008 [EU-GHS/CLP]
Skin corrosion (Category 1B)
Specific target organ toxicity - single exposure (Category 3)

Classification according to EU Directives 67/548/EEC or 1999/45/EC
Causes burns. Irritating to respiratory system.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008 [CLP]
Pictogram

Signal word Danger



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SDS – Safety Data Sheet


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Pictogram

Signal word Danger

- Hazards identification
- Handling and storage
- Personal protection
- Physical and chemical properties
- Stability and reactivity

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end uses
no data available

Cool place ≠ fridge

4-8 ºC = fridge

10. STABILITY AND REACTIVITY

10.1 Reactivity
no data available

10.2 Chemical stability
no data available

Sigma-Aldrich - 320331 Page 4 of 7

10.3 Possibility of hazardous reactions
no data available

10.4 Conditions to avoid
no data available

10.5 Incompatible materials
Bases, Amines, Alkali metals, Metals, permanganates, e.g. potassium permanganate, Fluorine, metal acetylides, hexalithium disilicide

10.6 Hazardous decomposition products
Other decomposition products - no data available

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Causes burns. Irritating to respiratory system.

2.2 Label elements

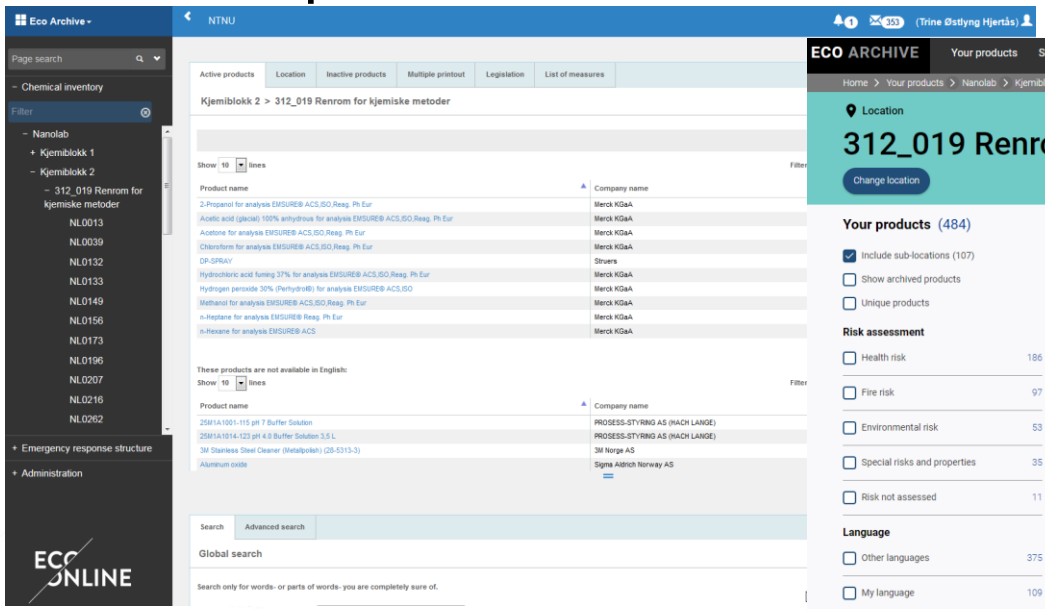
Labelling according Regulation (EC) No 1272/2008 [CLP]
Pictogram

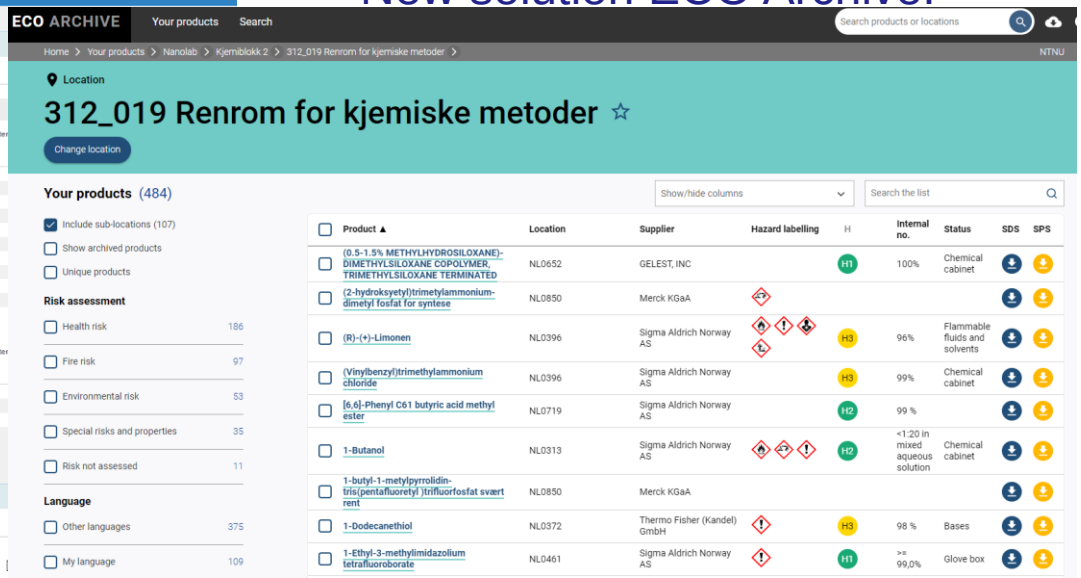
Signal word	Danger
Hazard statement(s)	
H314	Causes severe skin burns and eye damage.
H335	May cause respiratory irritation.
Precautionary statement(s)	
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/ physician.

SDS – Safety Data Sheet

- Available on paper in the cleanroom areas, both in Norwegian and English.
- Online in ECOonline's records of substances and products "ECO Archive".

New solution ECO Archive:





NanoLab provided chemicals

- All chemicals stored directly under a “Renrom” cleanroom location
  (not included sub-locations)

- Coloured risk evaluation that determines whether a buddy is required.

Kjemiblokk 2 > 312_019 Renrom for kjemiske metoder

Show 10 lines

H	Product name
	2-Propanol for analysis EMSURE® ACS,ISO,Reag. Ph Eur
	Acetic acid (glacial) 100% anhydrous for analysis EMSURE® ACS,ISO,Reag. Ph Eur
	Acetone for analysis EMSURE® ACS,ISO,Reag. Ph Eur
	Chloroform for analysis EMSURE® ACS,ISO,Reag. Ph Eur
	DP-SPRAY
	Hydrochloric acid fuming 37% for analysis EMSURE® ACS,ISO,Reag. Ph Eur
	Hydrogen peroxide 30% (Perhydrol®) for analysis EMSURE® ACS,ISO
	Methanol for analysis EMSURE® ACS,ISO,Reag. Ph Eur
	n-Heptane for analysis EMSURE® Reag. Ph Eur
	n-Hexane for analysis EMSURE® ACS

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Risk evaluation, health (H)

H1 Not hazardous.

H2 Not hazardous, work in a ventilated area, PPE?

H3 Hazardous, use fume hood, PPE, buddy work required.

H4 A more detailed risk assessment concerning both the chemical and the activity prior to work is needed.

H3  Necessary to register exposure information.

Risk evaluation of the NanoLab provided chemicals assumes you are working in accordance with the SDS.

Open work on lab bench or adding heat or pressure may alter the result (colour) of the evaluation.

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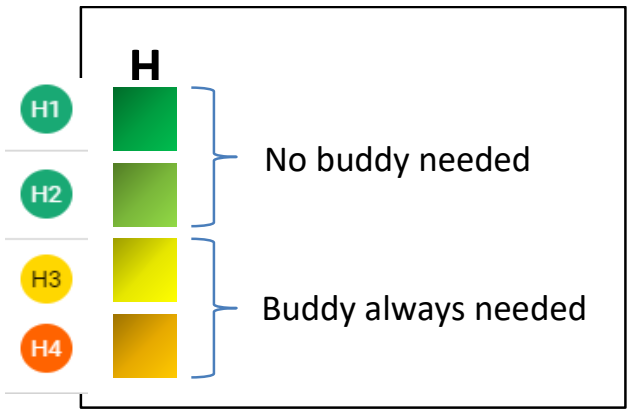
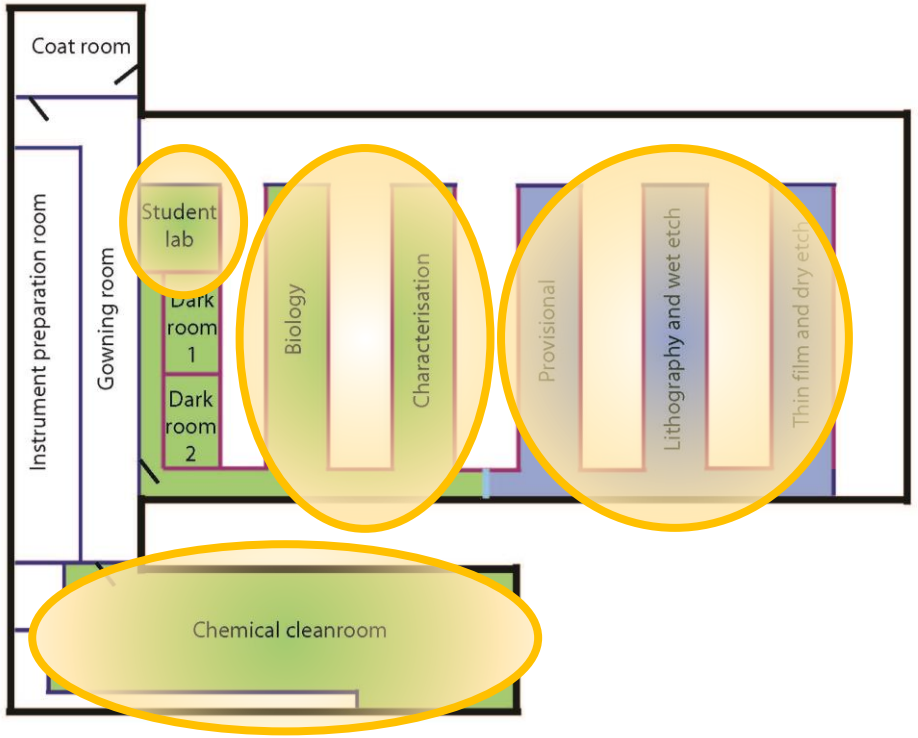
Buddy system





You must ask someone in the cleanroom to be your buddy.

<u>The buddy must:</u>

- Be in the same area as you.
- Be told what to do in case of a spill or an accident.
- Have cleanroom training.

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Registration of chemical exposure

Log for chemical exposure during work at NTNU NanoLab.

- carcinogenic chemicals
- mutagenic chemicals
- lead

- CNT (carbon nanotubes)
- nanoparticles of Titanium oxide
- nanoparticles of amorphous Silicon oxide

Chemical bottles are tagged with

Due to legislation, exposure to these chemicals have to be registered. In ECOonline such chemicals are tagged with ⚠ next to a yellow or orange square.

Name/ user no.: **Employment:**

Date	Chemical	Concentration	Duration	Exposure during work			
				Inhalation	Splashing into the eyes	Spills on the skin	Swallowing
				☐	☐	☐	☐
				☐	☐	☐	☐
				☐	☐	☐	☐

The log is found in the gowning room.

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Chemical waste categories

Diluted inorganic acids

Examples:

Waste product no: 7131

- Hydrochloric acid
- Sulphuric acid
- Nitric acid
- Phosphoric acid
- cold RCA-2
- cold Piranha

Fill the empty container with 10 volume% water.

EAL: 060106, UN3264
ADR: 8, emb. II (X, Y)

WASTE

Diluted inorganic acids *with heavy metals or nano materials

Examples:

Waste product no: 7131

- Hydrochloric acid*
- Sulphuric acid*
- Nitric acid*
- Phosphoric acid*
- cold RCA-2*
- cold Piranha*
- Chromium etch

Add 10 volume% water to empty container.
Heavy metals: As, Au, Fe, Cu, Co, Cr, Mn, Ni, Pt, Zn, Ag,Sn...
EAL: 060106, UN3289
ADR: 6.1+8, emb. II (X, Y)

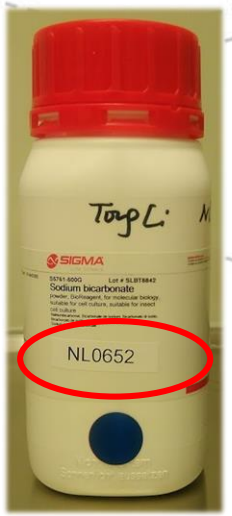
WASTE

- Placard with waste categories.
- Waste with heavy metals or NM.
- Acid and base bottles have a venting cap for gaseous waste (red or marked with a red label).
- The most hazardous component in your mixture determines the waste bottle.
- For other personal waste, the user/department of the user is responsible for disposal.

Category of waste	Examples	Comments
Halogenated organic solvents	- Solvents containing halogens (fluorine, chlorine, bromine, iodine). - PMMA Series resists	Content of halogen > 0,5%
Non-halogenated organic solvents	- Isopropyl alcohol (IPA, 2-Propanol) - Acetone - Ethanol - Heptane - Toluene - Non-halogenated resists - Non-halogenated thinners/ removers - Non-halogenated EBL developers	Content of halogen < 0,5%
Non-halogenated organic solvents *with heavy metals or nano materials	- Acetone* - Ethanol* - Heptane* - Toluene* - IPA* - Non-halogenated resists* - Non-halogenated thinners/ removers* - Non-halogenated EBL developers*	Content of halogen < 0,5% Heavy metals: As, Au, Fe, Cu, Co, Cr, Mn, Ni, Pt, Zn, Ag,Sn...
Waste water, wash water	Aqueous solution or water contaminated by organic material.	Content of halogen < 0,5%
Organic acids	- Acetic acid - Citric acid - Organic solvents mixed with acid	Fill the empty container with 10 volume% water.
Organic bases	- Amines - Photoresist developers - Organic solvents mixed with base	Fill the empty container with 10 volume% water.
Organic bases *with heavy metals or nano materials	- Amines* - Photoresist developers* - Organic solvents mixed with base*	Add 10 volume% water to empty container. Heavy metals: As, Au, Fe, Cu, Co, Cr, Mn, Ni, Pt, Zn, Ag,Sn...
Diluted inorganic acids	- Hydrochloric acid - cold RCA-2 - Sulphuric acid - cold Piranha - Nitric acid - Phosphoric acid	Fill the empty container with 20 volume% water.
Diluted inorganic acids *with heavy metals or nano materials	- Hydrochloric acid* - cold RCA-2* - Sulphuric acid* - cold Piranha* - Nitric acid* - Chromium etch - Phosphoric acid*	Add 20 volume% water to empty container. Heavy metals: As, Au, Fe, Cu, Co, Cr, Mn, Ni, Pt, Zn, Ag,Sn...
Hydrofluoric acid	Hydrofluoric acid (HF)	Add 10 volume% water to empty container.
Inorganic bases	- cold RCA-1 - Ammonia - Sodium hydroxide - Potassium hydroxide	Fill the empty container with 10 volume% water.
Inorganic bases *with heavy metals or nano materials	- cold RCA-1* - Ammonia* - Sodium hydroxide* - Potassium hydroxide*	Add 10 volume% water to empty container. Heavy metals: As, Au, Fe, Cu, Co, Cr, Mn, Ni, Pt, Zn, Ag,Sn... EAL: 060205, UN3289 ADR: 6.1+8, emb. II (X, Y)
Inorganic solid waste (may include heavy metals or nano materials)	- Inorganic samples (wafers) - Nano materials (allowed with container) - Scalpel blades, hypodermic needles - Contaminated grinding paper - Other metal containing waste	Heavy metals: As, Au, Fe, Cu, Co, Cr, Mn, Ni, Pt, Zn, Ag,Sn...
	No suitable waste bottle available? Prepare your own properly marked and signed waste bottle	Mark the bottle with activity number, name, content and warning labels to store it in the meantime (**not longer than one month**) in the NanoLab facilities.

Bringing chemicals into the cleanroom

- Fill in the form “Introducing chemicals” found on LIMS (Info, General documents), the SDS can be helpful.
- Send the form to nanolab@ntnu.no
- All personal chemicals must be accepted before they are taken into the cleanroom.
- You get a special sticker with your activity number when your chemical is accepted.
- Chemical flasks without a sticker even with an active activity number and correct coloured dot can be removed from the cleanroom without warning.



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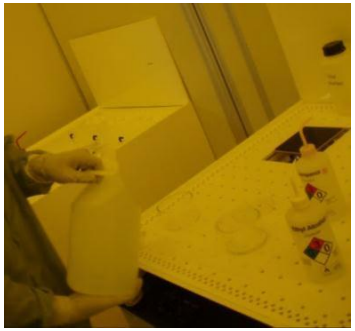
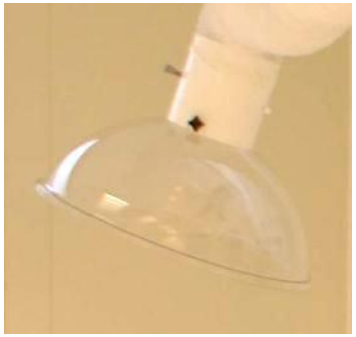
Ventilated work areas

- Work with hazardous chemicals must always be performed in a **fume hood**.
- Keep hood sash down during work.
- The fume hood is not a storage place, tidy up before you leave!
- Less hazardous chemicals can also be used in other ventilated areas such as the chemical benches and under suction hoods.





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Laminar air flow (LAF)-cabinets

- Protect your sample from particles.
- Do not protect you or the environment from hazardous substances.

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Ventilated storage cupboards for

- Acids
- Bases
- Chemicals (no acids or solvents)
- Flammable fluids and solvents
- Toxic substances (padlock 4444)
- *PDMS fume hood*
- *HF (Hydrofluoric acid)*

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Cooled storage places without ventilation

- Fridge

In chemical area and litho area

- Freezer

In chemical area

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Solid chemicals/ powder

- Stored in the chemical area.
- Used in ISO 7 areas, NOT in ISO 5 or 6 areas.
- When dissolved in a solution, you can bring it to ISO 5 or 6.

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Transport of chemicals

- Black - Coat room, gowning room and supporting labs (outside the cleanroom).
- White - In the cleanroom.

Bottle carriers

NEVER carry chemicals by the lid!

PPE (Personal protection equipment)

- Solvent Resistant Gloves (nitrile).

- Acid Resistant Gloves (nitrile, neoprene and rubber), also good alkaline protection.

- Safety goggles (wear them if you are using contact lenses).

- Face shield.

- Protective Apron in nitrile.

- Tychem apron with long sleeves.

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Protective gloves

- Make sure that the gloves cover the cuff and lower part of the sleeve.
- Avoid contamination.
- Always clean the outside of protective gloves before you take them off.
- Take off the gloves by loosening the fingers first, then pull them off.
- **Remove your gloves when you answer the telephone or touch ANYTHING outside the contaminated working space (hood)!**

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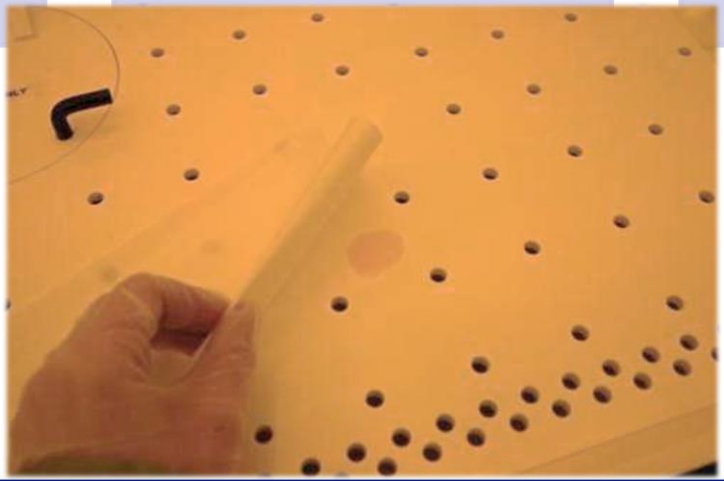
Chemical spills

- Action depends on AMOUNT and TYPE of chemical
- Think BEFORE you use a chemical what your and your buddys reaction should be at a spill.
- 4 senarios:
    1) Small spill without health risk
    2) Small spill with health hazard, manageable by you
    3) Spill of corrosive materials
    4) Spills posing health risk and/ or a fire hazard

Small spill, no health danger

Example	Cleaning material	Reaction
• Small chemical spill	• Cleanroom wipe	• Wipe up • Throw wipe in dustbin



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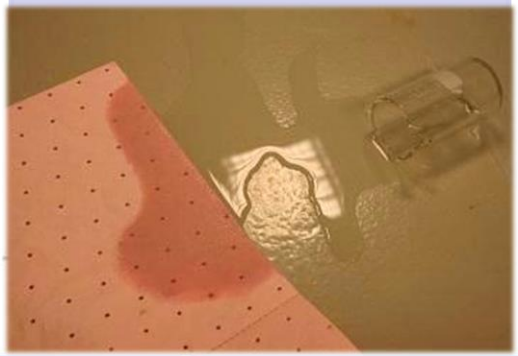
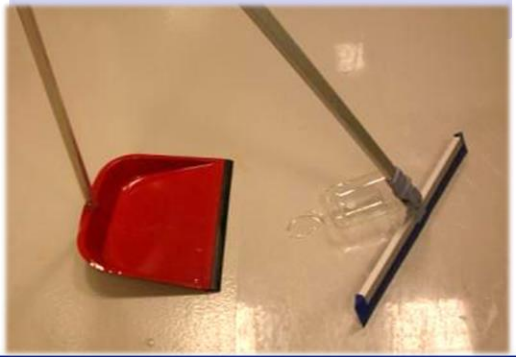
Small spill with health hazard, manageable by you

- Wet or dry chemicals, or broken glass.

Example	Cleaning material	Reaction
• Broken beaker of liquid chemical	• Hazmat pad • Squeegee	• Soak it up or collect • Put waste in white bucket





ALWAYS ALERT AN ENGINEER!!

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Spill of corrosive materials

- May etch the bench or floor.

Example	Cleaning material	Reaction
• Bottle of acid or base	• Water • (Engineer will do the cleanup)	• Dilute with water • Evacuate area • Alert an engineer

Spills posing health risk and/ or a fire/ explosion hazard

Example	Cleaning material	Reaction
• Bottle of solvent or developer	• None • (Engineer will do the cleanup)	• Evacuate the entire cleanroom • Alert an engineer

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Labelling chemicals/solutions/samples

- *when you are in the cleanroom*

- **Content**

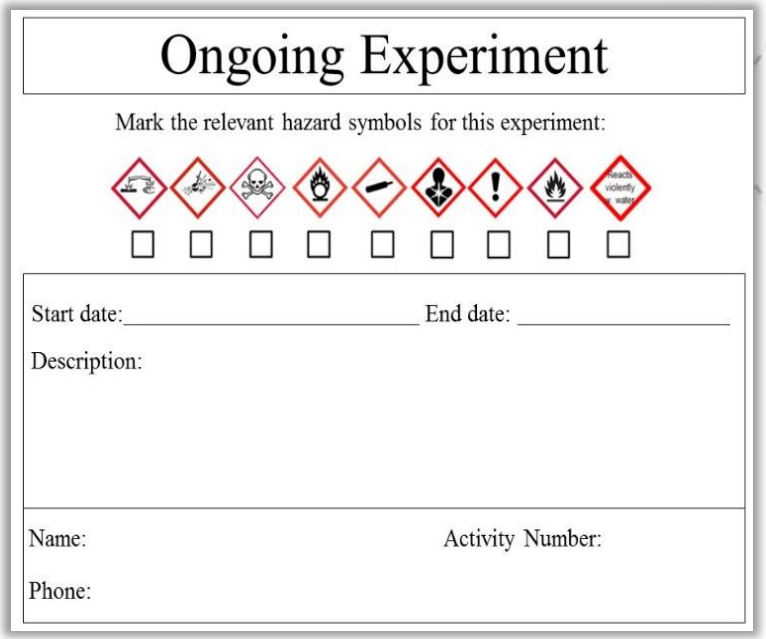
- ALWAYS mark the container itself, not the lid, nor just a note on or nearby the container.

- <u>Empty and clean</u> temporary containers before you leave the cleanroom.

Labelling chemicals/solutions/samples

- if leaving the cleanroom during an ongoing experiment

- **Content** (mark the container itself).
- Laminated warning sheets (leave it on the sash).
- All labware that is not an active part of the ongoing experiment must be cleaned up before you leave!


Ongoing Experiment

Mark the relevant hazard symbols for this experiment:

Start date:_____ End date: _____

Description:

Name: Activity Number:

Phone:

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Labelling chemicals/solutions/samples

- for storage in cabinets

- **Content** (mark the container itself)
- **Name** / activity number
- **Colored dot** (new colour each year)
- **Hazard warning labels**

- NEVER leave anything containing chemicals (or water) unmarked!

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Labeling equipment

- Write-on-label tape dispenser (temporary)
- Dymo labelprinter (permanent)
- Marking pen

- Remove all markings before the container goes into the dishwasher.

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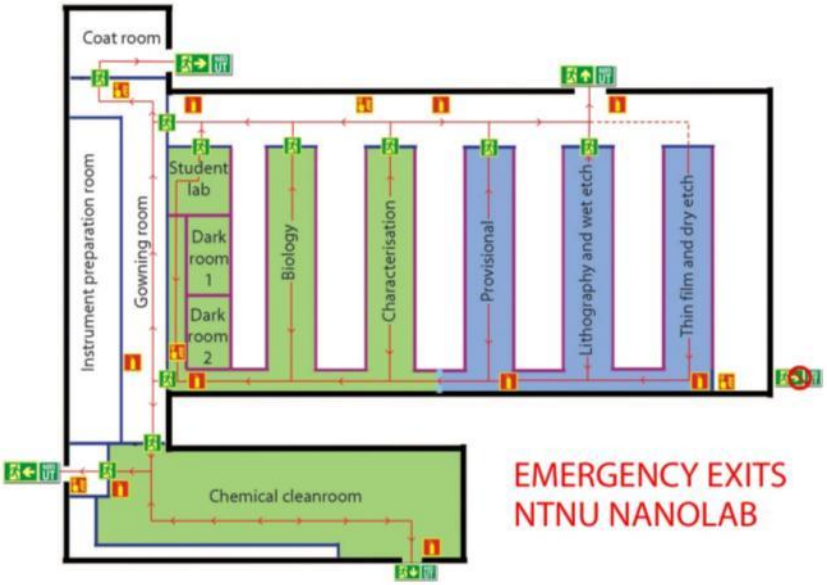
Evacuation alarm

- Turn off heat and gas supply.
- Close hood.
- Take off protective gloves and apron.
- Leave the laboratory through the nearest exit.



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Welcome to NTNU NanoLab

nanolab@ntnu.no

Thank you for your attention!

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