Chemical Safety for Science Teachers

June 17th 2024

Stockholm University

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Kemilärarnas resurscentrum

Link to Presentation

https://www.su.se/kemilararnas-resurscentrum/kemisäkerhet/material-från-säkerhetskurser-1.665761

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In which bottles and cabinets should the chemicals be stored?

How often should emergency showers and eyewashes be checked?

Do chemicals get old? When should they be discarded?

What can (not) be poured down the sink?

Image by brgfx on Freepik

Is it ok to only have safety data sheets online or do they have to be in paper form?

How should tasks be distributed?

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Times	Content
9.00	Chemicals Legislation
10.00	Fika
10.15	Chemical Inventory List and Substitution
11.15	Storage – Labelling - Waste
12.00	Lunch
13.00	Practical Task
14.15	Risk Assessment
15.00	Fika
15.15	Routines, Information and Work Environment
	Distribution of Tasks
16.30	End time

What do the curriculums say?

From Curriculum for Compulsory School, Years 4–6 Lgr22 (English)

- *Common household chemicals. Their use and impact on the environment and humans, and how they are labelled and should be handled*.

From Curriculum for Compulsory School, Years 7–9 Lgr22 (English)

- *Observations and experiments using both analogue and digital tools. Formulation of research questions, planning, performance, evaluation of results and documentation with images, tables, diagrams and reports.*

From chemistry curriculum for the upper secondary school Gy11 (English)

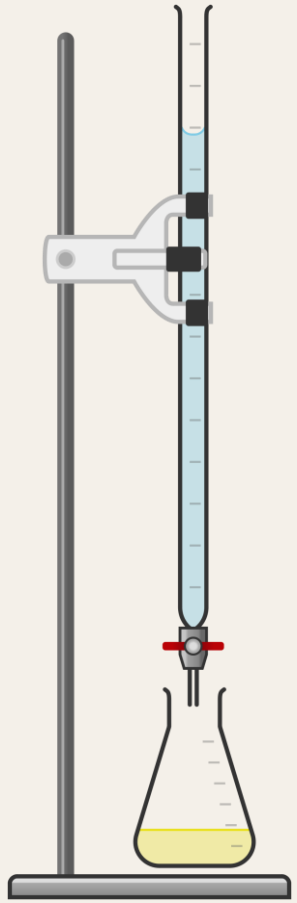
- *The ability to plan, carry out, interpret and report experiments and observations, and also the ability to handle chemicals and equipment.*

Link to commentary material the chemistry Curriculum, Lgr22 at Skolverket (Swedish)

Are chemicals needed in teaching?

The upper secondary school Thoren Business School Stockholm - is no longer allowed to offer the Science program, according to the Swedish School's Inspectorate decision (2024-05-20). Some excerpts from the report

- ”the school is not equipped with fume hoods, which are needed when dangerous chemicals are to be handled in laboratories to protect the user from exposure to dangerous substances.”
- ”Since burettes, which are used for titrations, were missing in the school's science room, the School Inspectorate notes that it has not been possible to carry out such a laboratory.”
- ”The teaching has only on a few occasions included scientific work methods that include carrying out experiments where the students were given the opportunity to handle chemicals.”



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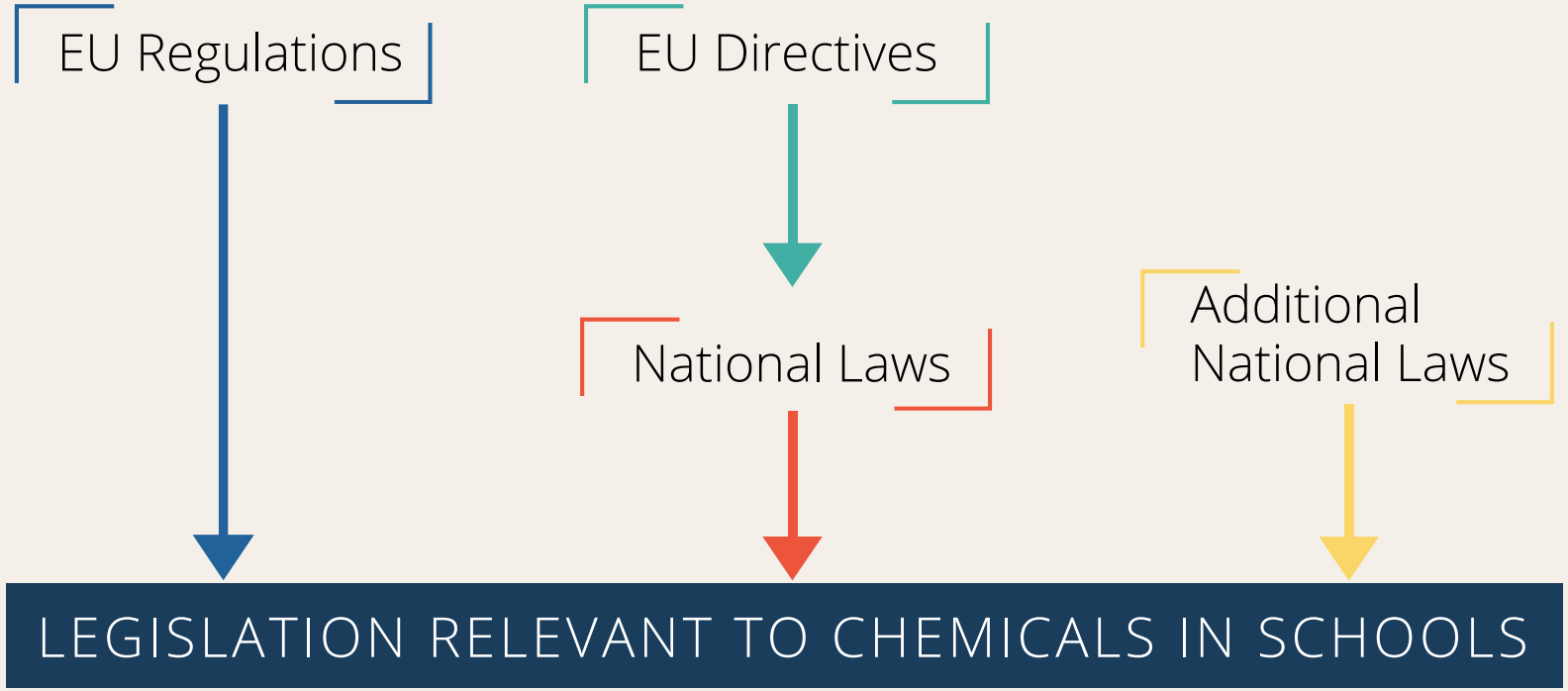
Chemicals legislation – our “seat belt”

Overview of European Chemicals Legislation



- The Classification, Labelling and Packaging Regulation (CLP)
- The Registration, Evaluation, Authorization and Restriction of Chemicals Regulation (REACH)

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General Principles of EU Chemical Law

Prevention principle	It is better to prevent t han to repair.
Precautionary principle	Authorities must take appropriate measures to prevent specific potential risks to public health, safety and the environment. These interests precede economic interests.
Polluter pays principle	The one who causes pollution to the environment is responsible for paying for the damage.

Authorities of relevance to school chemistry

Authority
Work environment
Flamable and explosive substances
External environment and waste
Curricula
Information for producers

SWEDISH WORK ENVIRONMENT AUTHORITY

MSB Swedish Civil Contingencies Agency

NATUR VÅRDS VERKET The Swedish Environmental Protection Agency

Skolverket The National Agency for Education

KEMI Swedish Chemicals Agency

Stockholms stad

HELSINGBORG

- Exercise of authority - Constitutions with laws - General advice - Inspections
- The authorities have no obligation to actively inform.
- Classroom work as well as teachers' pre- and post-work is covered.

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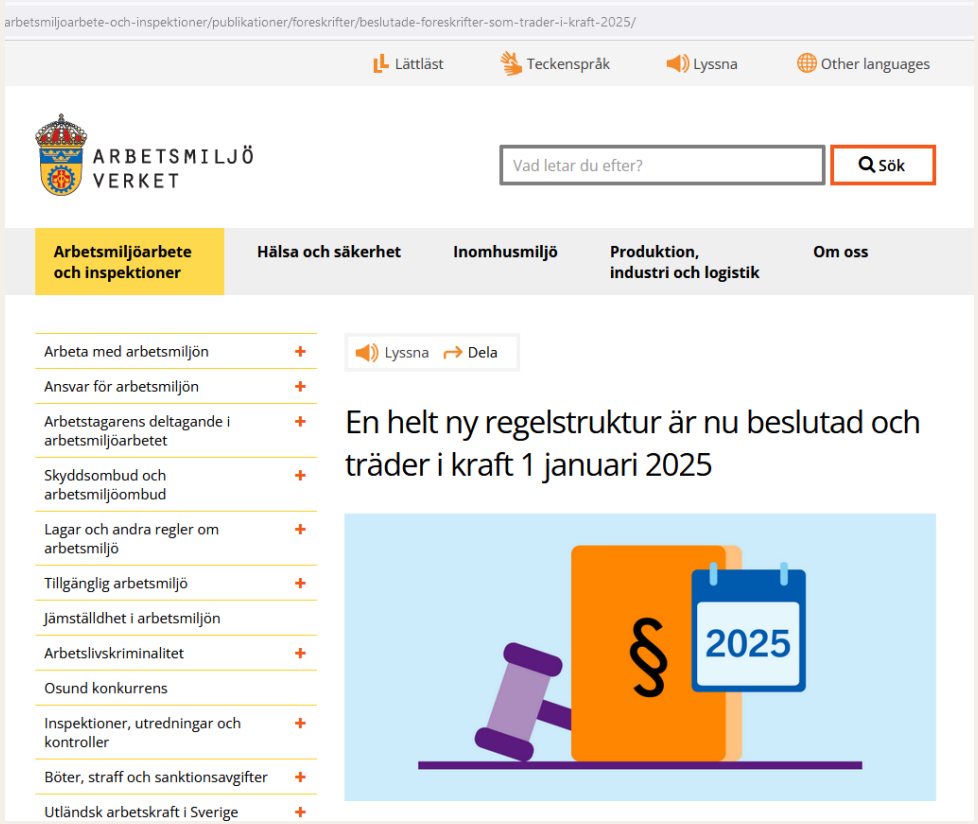
Swedish work environment authority – new structure of rules 250101



The provisions have been worked on as they have been sorted into the new structure but the aim has been to maintain the same requirements and protection levels.

New structure of provisions of Swedish Work Environment Authority, Link (Swedish)

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The design of the workplace

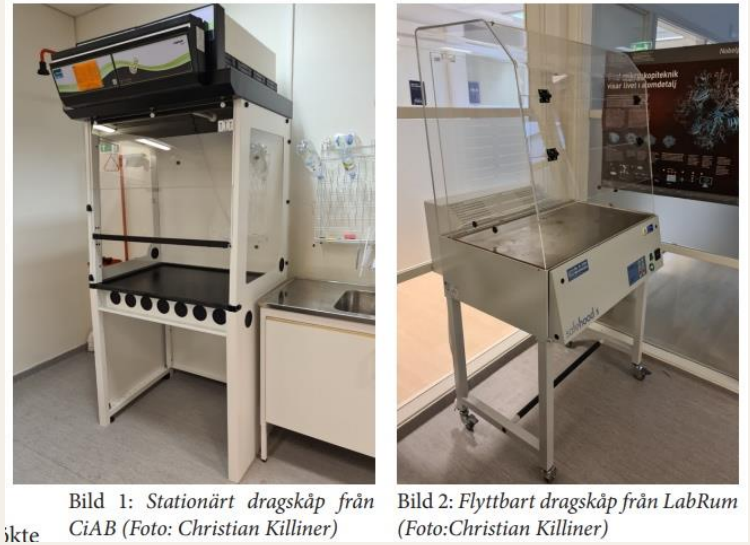


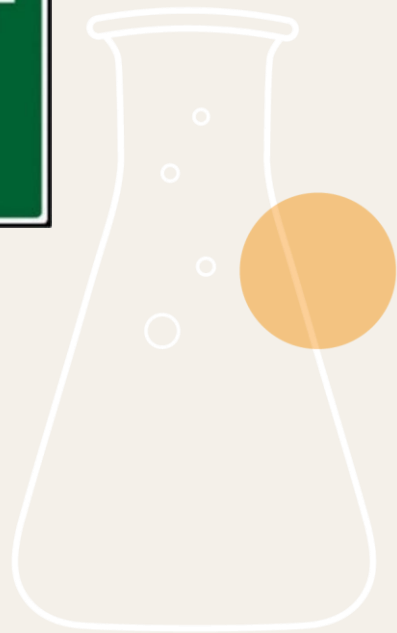
Bild 1: *Stationärt dragskåp från CiAB (Foto: Christian Killiner)*

Bild 2: *Flyttbart dragskåp från LabRum (Foto:Christian Killiner)*

→ Article about fume hoods with filter, Killiner, IB1-2022 (In Swedish)

AFS 2020:1 (in Swedish)

- Emergency shower, eye-wash station
- First aid
- Fire extinguisher
- Fire blankets
- Emergency exit



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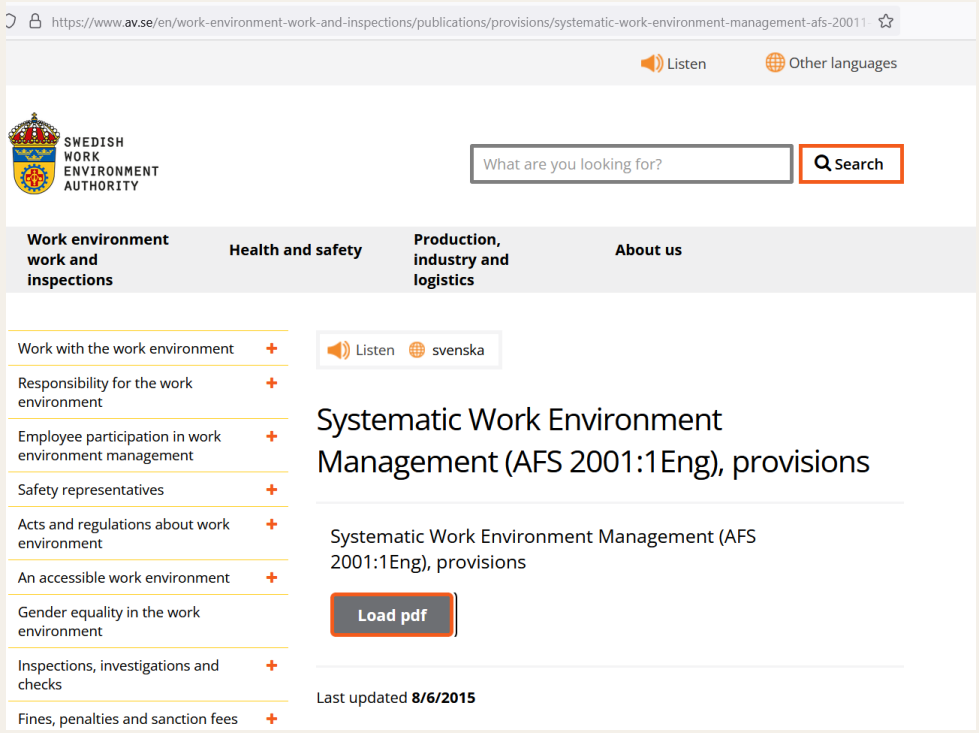
Swedish provisions about work environment



- Systematic Work Environment Management (SAM) AFS 2001:1Eng
- Chemical Hazards in the Working Environment AFS 2011:19Eng
- First aid and crises support AFS 1999:7Eng
- The design of the workplace AFS 2020:1, (Arbetsplatsens utforming in Swedish)

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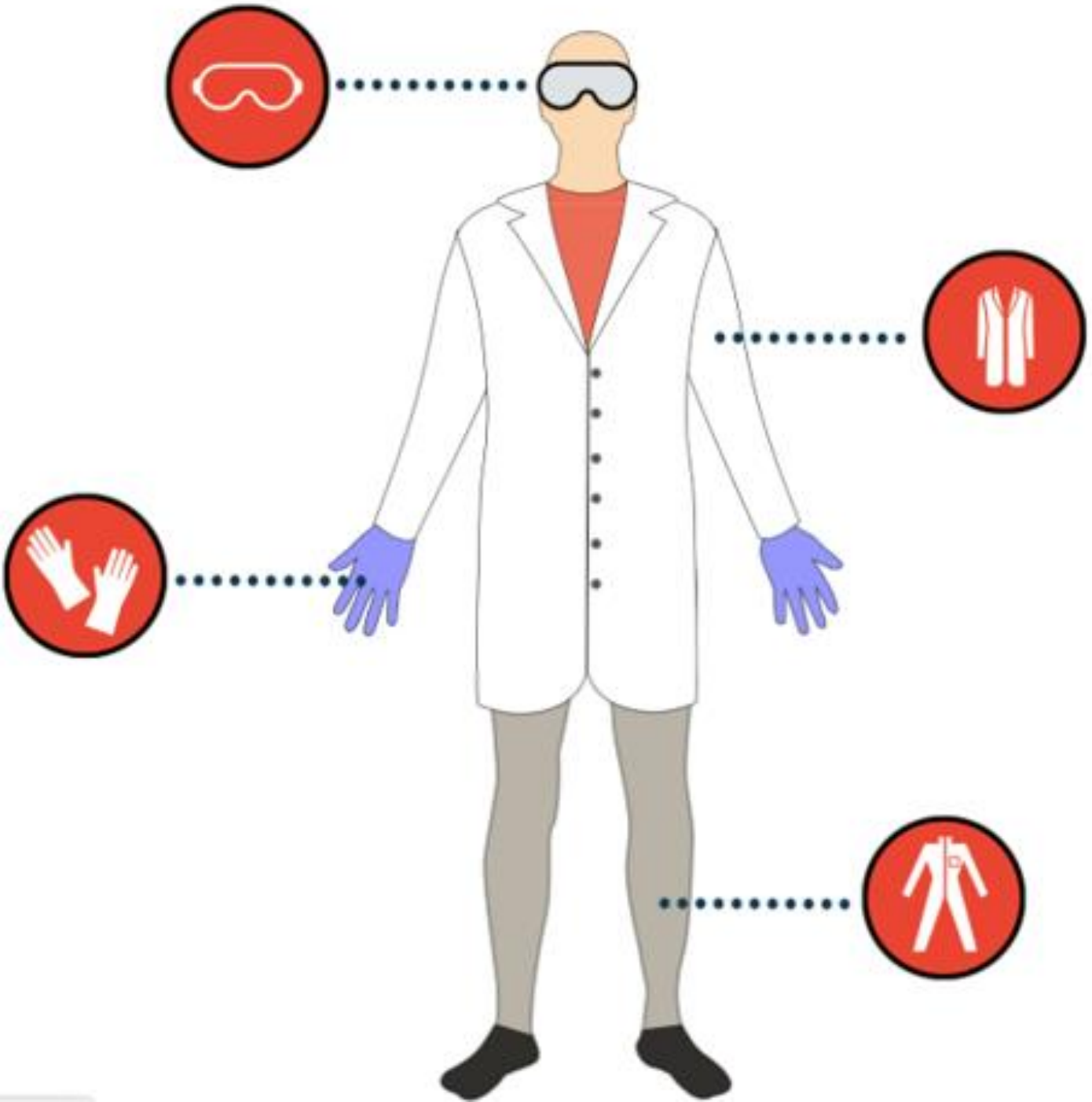

Protective equipment

Image: Chimactiv

The eye with nitric acid
The eye with a lens

→ Take care of your hands - choose the right protective gloves against chemicals, brochure in Swedish.

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Flammable substances Swedish Civil Contingencies Agency (MSB)

- Flammable gases, liquids, fire-reactive and explosive substances. MSBFS 2020:1
- If the school has more than 2 liters of LPG (4 small camping bottles), a permit is needed.

→ MSB: LPG in schools (in Swedish)

→ Manager of flammable goods (in Swedish)

→ CheSSE.org/sv/ about flammable goods (in Swedish)

Swedish Civil Contingencies Agency

Myndigheten för samhällsskydd och beredskap

BRANDFARLIGA VAROR

Föreståndare

Denna information är riktad till dig som är föreståndare för hantering av brandfarliga gaser och vätskor, och till dig som är tillståndshavare och ska utse föreståndare.

När behövs föreståndare?

att se till att personalen får den utbildning och fortbildning de behöver för detta. Det är också viktigt att följa upp att hanteringen sker på ett betryggande sätt.

Observera att föreståndaransvaret inte innebär ett jouransvar. Föreståndarens uppgift handlar om det förebyggande skyddet, inte beredskap vid olyckor.

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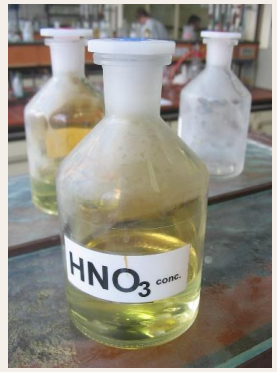
Explosives precursors



…… substances that can be used as starting materials in the manufacture of explosives.

- EU-regulation 2019/1148 applies from 1st February 2021 (Examples in Appendices I and II)
- End user insurance
- Obligation to report thefts, disappearances and "suspicious transactions" within 24 hours. For example someone trying to gain access to precursors (who should not have it): prekursor@polisen.se or 114 14

Polisen

Appendix I
Hydrogen peroxide
Nitromethane
Nitric acid
Potassium chlorate
Sodium chlorate
Potassium perchlorate
Sodium perchlorate
Sulfuric acid
Ammonium nitrate

Appendix II
Acetone
Hexamine
Potassium nitrate
Sodium nitrate
Calcium nitrate
Calcium ammonium nitrate
Magnesium nitrate
Aluminum powder
Magnesium powder

Foto: KRC

Explosive substances

Solid or liquid substances or mixtures which in themselves, through chemical reaction, can produce gases at such a temperature and such a pressure, and at such a speed, that they can damage the surroundings.

- The manufacture of explosive goods is subject to a permit according to MSBFS 2019:1 (in Swedish).
- KRC's comments on the ongoing revision of MSBFS 2019:1 (in Swedish) → LINK

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Examples of experiments that need permission

Name (and link to films)	Chemicals
Svartkrut	Potassium nitrate, $KNO_3(s)$, carbon, sulphur
nitrated cellulose	Cellulose, sulphuric acid, nitric acid
”Bang powder”	Potassium chlorate, $KClO_3(s)$, sulphur
Potassium nitrate with a) carbon och b) sugar	$KNO_3(l)$, carbon, sugar
Screaming Jelly Baby	Potassium per chlorate, $KClO_4(l)$, candy
Ammonium nitrate and zinc with ammonium chloride (catalyst)	$NH_4NO_3(s)$, zinc, $NH_4Cl(s)$
Potassium chlorate with sugar and iron powder	$KClO_3(s)$, sugar, iron
Bengal fire	$KClO_3(s)$, sulphur, metal nitrate of Sr, Ba…
Potassium permanganate and glycol	$KMnO_4(s)$, $C_2H_4(OH)_2$

Link to instructions from KRC (in Swedish)

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Permission regarding ethanol

Folkhälsomyndigheten
PUBLIC HEALTH AGENCY OF SWEDEN

In addition to what is stated in Ch. 6. Section 5 of the Alcohol Act on who has the right to buy technical alcohol the following applies:

Anyone who conducts school activities in accordance with the Schools Act (2010:800) and needs technical alcohol for teaching may purchase a maximum of 15 liters of technical alcohol per calendar year.

According to the Public Health Agency's regulations and general advice on technical spirits and alcoholic preparations (In Swedish: HSLF-FS 2022:63)

To produce ethanol in schools, permission is required from both the Public Health Agency of Sweden and the Tax Agency. Permission is **unlikely** to be granted. Article in Swedish KRC:s IB nr 1 2022

Skatteverket

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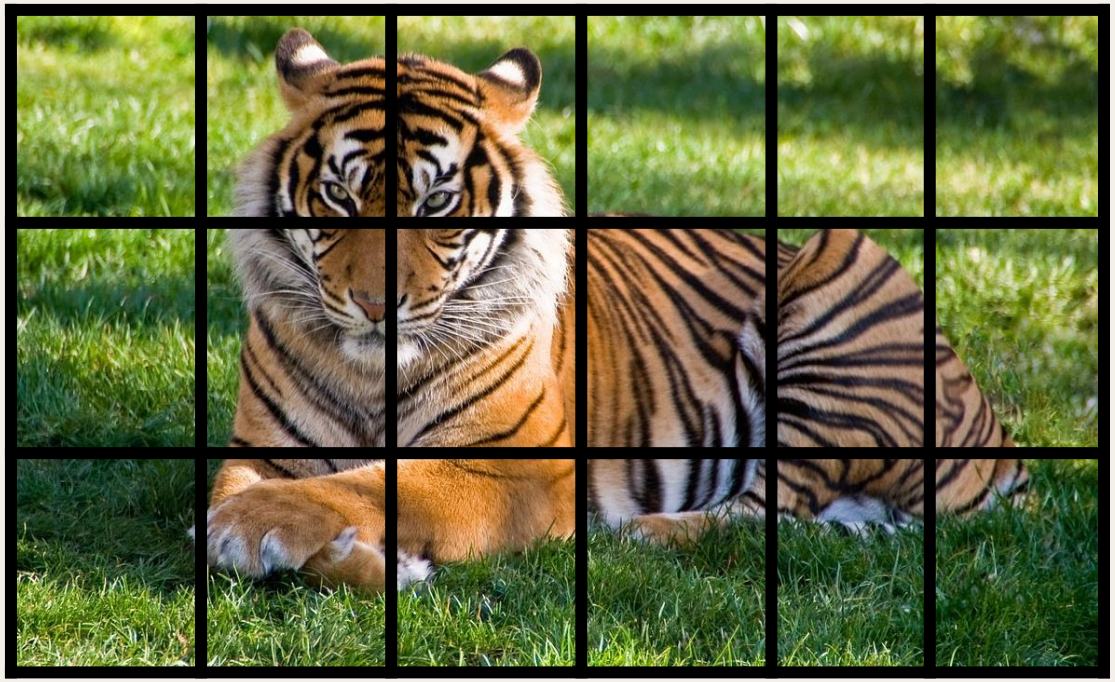
Chemicals with hazardous properties



Foton: Hämtade från commons.wikimedia.org

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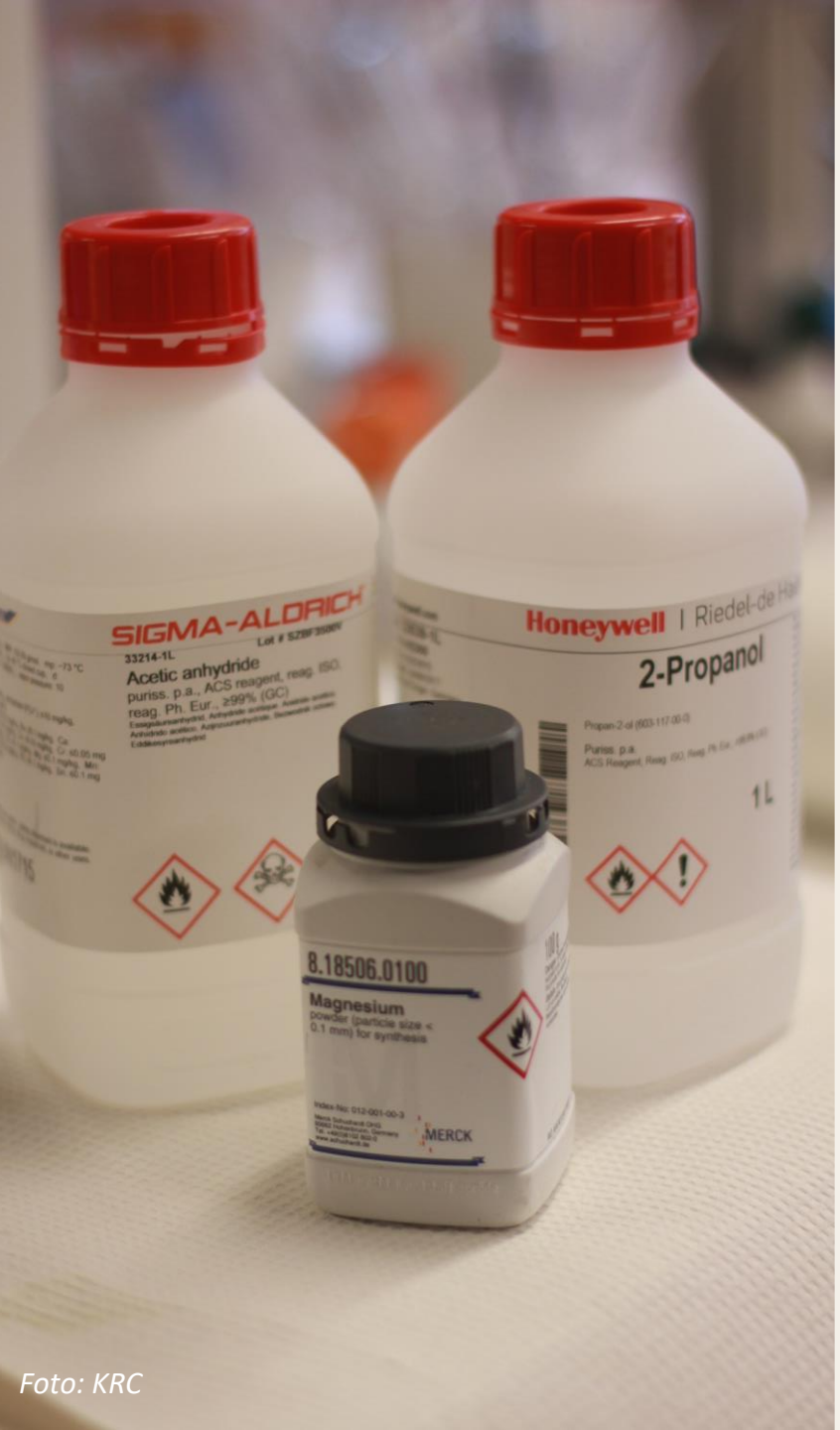

Foto: KRC

List of Chemicals

6 § AFS 2011:19 *(with amendments AFS 2022:4, in Swedish)*

- the name and date of the listing;
- Hazardous properties - Hazard statements
- where a chemical hazard is stored, used or formed;
- hygienic limit value, if there is one (AFS 2018:1, in Swedish)
- other occupational safety and health regulations specific to the substance.

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Chemical inventory list

[Name of school and department]

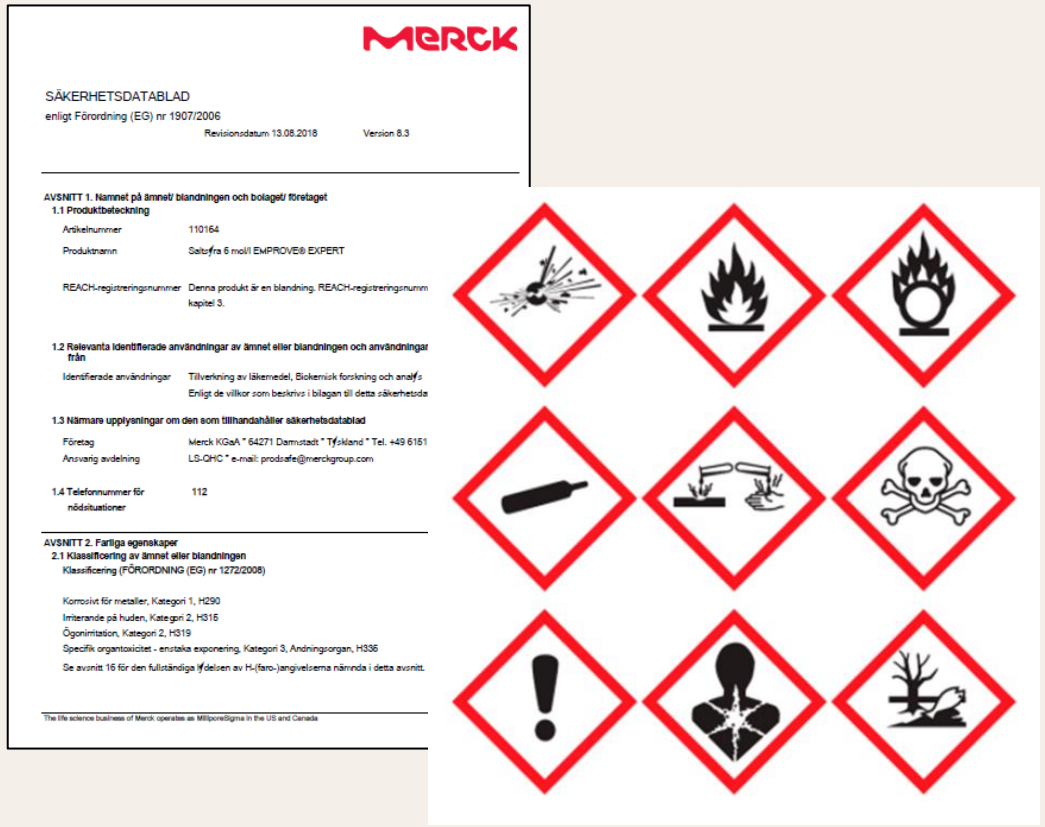
Chemical substance	Date	Concentration	Amount	Storage	Use	Signal word
Ammonia, NH_3	2022-12-09	c > 25 %, c > 13.4 M	1 L	Cupboard 2	laborations and demonstrations	Danger
Ammonia, NH_3	2022-12-09	1 < c < 3 %, 0.6 < c < 1.7 M	5 L	Cupboard 2	laborations and demonstrations	Warning

→ CheSSE template

→ KRC's template (more extensive, but in Swedish)

The templates are Excel sheets

Where to find information about the properties of chemicals



MERCK

SÄKERHETSDATABLAD
enligt Förordning (EG) nr 1907/2006
Revisionsdatum 13.08.2018 Version 8.3

AVSNITT 1. Namnet på ämnet/ blandningen och bolaget/ företaget
1.1 Produktbeteckning
Artikelnummer 110164
Produktnamn Saltsyra 6 mol/l EMPROVE® EXPERT
REACH-registreringsnummer Denna produkt är en blandning. REACH-registreringsnumm kapitel 3.
1.2 Relevanta identifierade användningar av ämnet eller blandningen och användningar från
Identifierade användningar Tillverkning av läkemedel, Biokemisk forskning och analys
Enligt de villkor som beskrivs i bilagan till detta säkerhetsda
1.3 Närmare upplysningar om den som tillhandahåller säkerhetsdatablad
Företag Merck KGaA * 64271 Darmstadt * Tyskland * Tel. +49 6151
Ansvarig avdelning LS-QHC * e-mail: prodsafe@merckgroup.com
1.4 Telefonnummer för nödsituationer 112

AVSNITT 2. Farliga egenskaper
2.1 Klassificering av ämnet eller blandningen
Klassificering (FÖRORDNING (EG) nr 1272/2008)
Korrosivt för metaller, Kategori 1, H290
Irriterande på huden, Kategori 2, H315
Ögonirritation, Kategori 2, H319
Specifik organtoxicitet - enstaka exponering, Kategori 3, Andningsorgan, H335
Se avsnitt 16 för den fullständiga lydelsen av H-(faro-)angivelserna nämnda i detta avsnitt.

The life science business of Merck operates as MilliporeSigma in the US and Canada

- Safety data sheet (SDS) VWR, Sigma Aldrich
- Chemical management system (KemRisk, Chemgroup, Klara…)
- KRC's chemical list
- CheSSE:s label generator for common chemicals

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The sections of the safety data sheet (SDS)

1	Identification of the substance	9	Physical and chemical properties
2	**Hazards identification**	10	Stability and reactivity
3	Composition and information on ingredients	11	Toxicological information
4	First aid measures	12	Ecological information
5	Fire fighting measures	13	Disposal considerations
6	Accidental release measures	14	Transport information
7	Handling and storage	15	**Regulatory information**
8	Exposure controls and personal protection	16	Other information

Hazard statements and precautionary statments

Overview of codes for hazard (H-) statements according to CLP.

CODE	TYPE OF HAZARD
H200–H299	Physical hazard
H300–H399	Health hazard
H400–H499	Environmental hazard

Overview of codes for precautionary (P-) statements according to CLP.

CODE	TYPE OF PRECAUTION
P100–P199	General
P200–P299	Prevention
P300–P399	Response (measures)
P400–P499	Storage
P500–P599	Disposal

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→ CheSSE om märkning

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Labelling of hydrochloric acid, HCl

Concentration	Hazard pictograms	Signal word	H phrases	P-phrases
C ≥ 6.8 M C ≥ 25%		Danger	Causes serious corrosive damage to skin and eyes. May cause respiratory irritation.	Use eye protection. IF SWALLOWED: Rinse mouth. DO NOT induce vomiting. IF ON SKIN (or hair): Immediately remove all splashed clothing. Rinse skin with water [or shower]. IF IN EYES: Rinse carefully with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a doctor immediately.

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6.8 M > C ≥ 2.7 M 25% > C ≥ 10%		Warning	Causes skin irritation. Causes serious eye irritation. May cause respiratory irritation.	Wash hands thoroughly after handling. Use eye protection. IF IN EYES: Rinse carefully with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Seek medical attention.

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→ CheSSE CheSSE on labelling

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C < 2.7 M C < 10%	**Not subject to labeling**			

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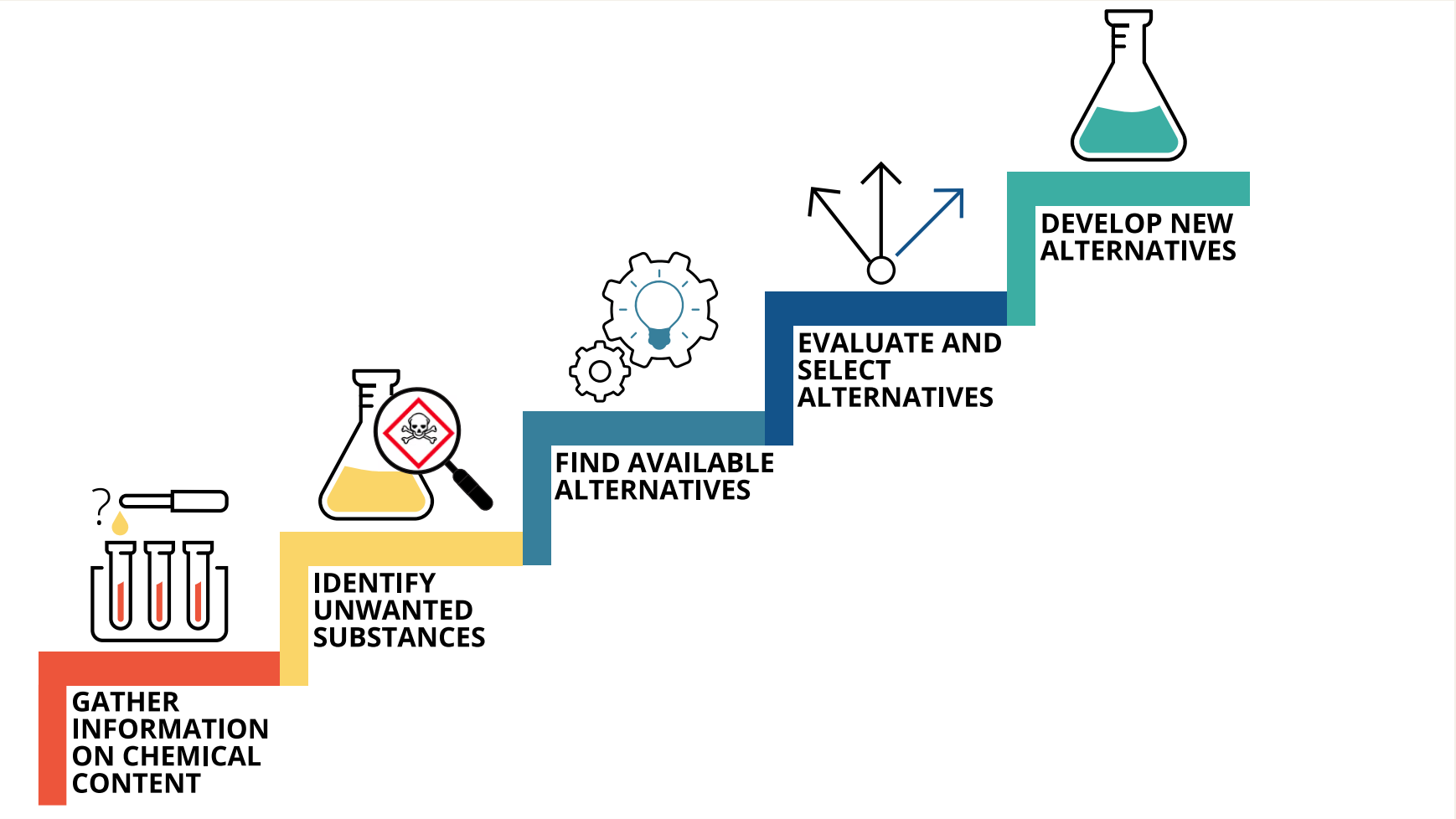
Substitution



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→ CheSSE on substitution

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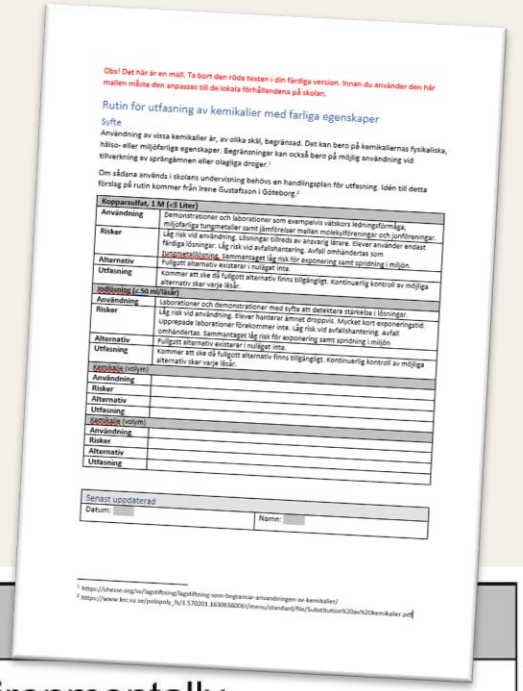
Example of routine for substitution

Based on an example presented by Irene Gustafsson, Göteborg, 2021.

→ Link to template (in Swedish)



Copper sulfate, 1 M (<3 Liter)	
Use	Demonstrations and laboratories such as the conductivity of liquids, environmentally hazardous heavy metals and comparisons between molecular compounds and ionic compounds.
Risks	Low risk in use. Solutions are prepared by the responsible teacher. Students only use ready-made solutions. Low risk in waste management. Waste is disposed of as heavy metal solution. Overall, the risk of exposure and spread in the environment was low.
Alternative	A fully adequate alternative does not currently exist.
Phasing out	Will take place when adequate alternatives are available. Continuous control of possible alternatives takes place every academic year.

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Storage

→ CheSSE on the storage of chemicals

CABINET	STORAGE REQUIREMENT(S)	HAZARD PICTOGRAM
Cabinet 1: ▪ OXIDISING AGENTS	Separated from flammable substances. Metal cabinet.	
Cabinet 2: ▪ FLAMMABLES – including organic solvents ▪ WATER REACTIVE SUBSTANCES	Ventilated metal cabinet. Notes: Flammable chemicals can catch fire spontaneously. Water reactive substances can react violently in contact with water.	
Cabinet 3: ▪ ACIDS – both organic and inorganic	Ventilated cabinet. Store containers below eye level. Advice: Concentrated acids should be stored in secondary containers.	
Cabinet 4: ▪ BASES – both organic and inorganic	Ventilated cabinet. Store containers below eye level. Advice: Concentrated bases should be stored in secondary containers.	
Cabinet 5: ▪ TOXIC – acute toxicity, carcinogenic, mutagenic and toxic for reproduction (CMR). Aquatic acute.	Cabinet, ventilated if containing volatile substances.	
Cabinet 6: ▪ GASES – propane/butane burners (flammable) and hydrogen	Ventilated, fire-proof cabinet. Do not store near flammable chemicals. The cabinet has to be marked with a yellow “gas under pressure” sign.	

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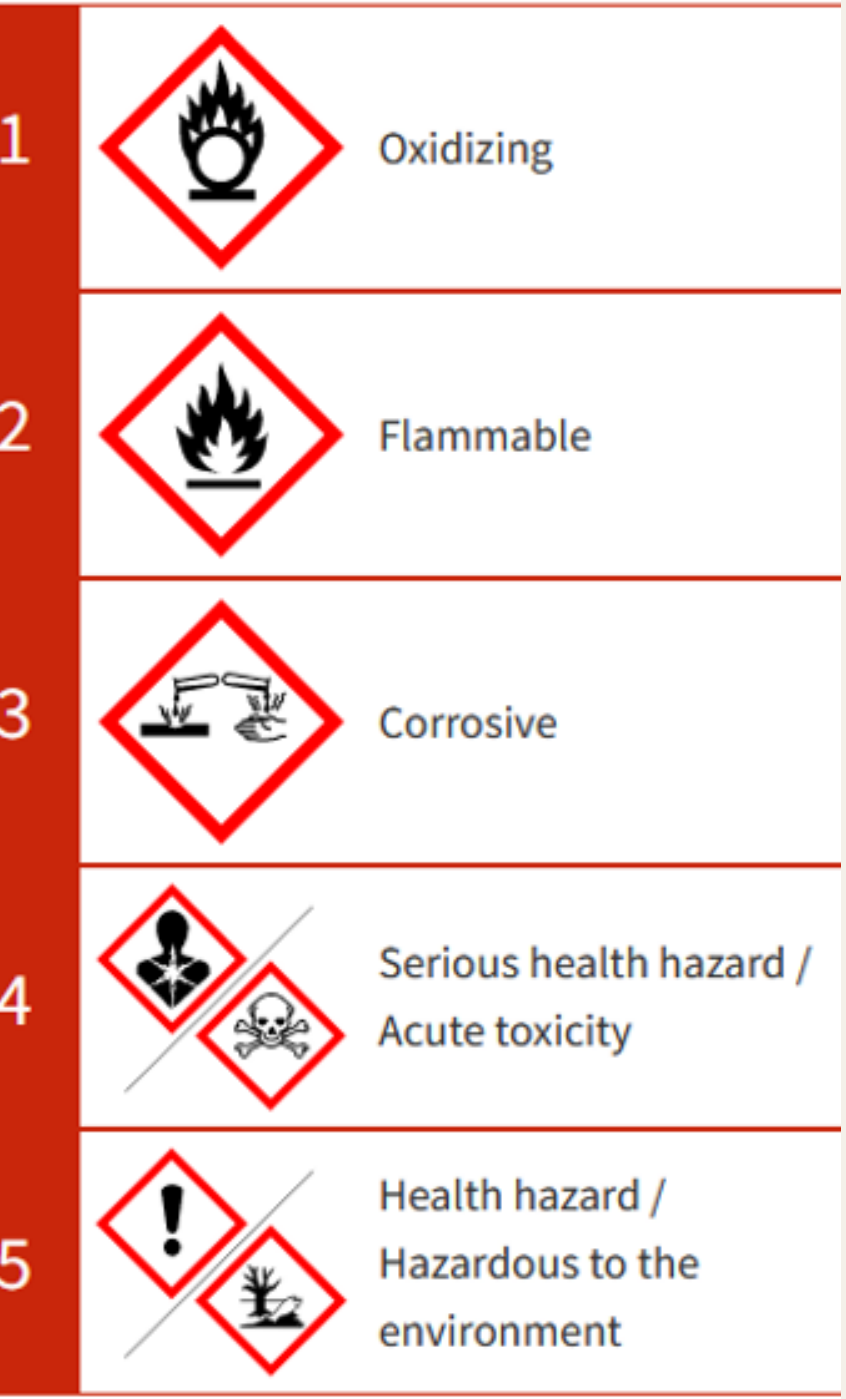
Which pictogram is most important?



If a chemical has several hazard pictograms, it should be stored in the highest priority category. The image shows the order of priority

Oxidizing agents have the highest priority followed by flammable substances. Examples of oxidizing substances:

- nitrates (NO_3^-)
- chlorates (ClO_3^-)
- perchlorates (ClO_4^-)
- hydrogen peroxide (H_2O_2)
- permanganates (MnO_4^-).

→ CheSSE on the storage of chemicals

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Unsuitable joint storage

Table of possibilities of co-storage of chemicals.

	OXIDIZING 	FLAMMABLE 	CORROSIVE: ACID 	CORROSIVE: BASE 	HEALTH HAZARD / TOXIC 
OXIDIZING 	Compatible	Not compatible	Store according to SDS Section 7 and 10	Store according to SDS Section 7 and 10	Store according to SDS Section 7 and 10
FLAMMABLE 	Not compatible	Compatible	Not compatible	Not compatible	Store according to SDS Section 7 and 10
CORROSIVE: ACID 	Store according to SDS Section 7 and 10	Not compatible	Compatible	Not compatible	Not compatible
CORROSIVE: BASE 	Store according to SDS Section 7 and 10	Not compatible	Not compatible	Compatible	Store according to SDS Section 7 and 10
HEALTH HAZARD / TOXIC 	Store according to SDS Section 7 and 10	Store according to SDS Section 7 and 10	Not compatible	Store according to SDS Section 7 and 10	Compatible

- **Acids - bases** e.g. NH_3 and HCl
- **Combustible – oxidizing**

  for example Mg (powder) and $KMnO_4$ or KIO_4
- **Flammable liquids - flammable gas,** e.g. ethanol and hydrogen

In practice, it is not easy to achieve this - you have to do your best.

→ CheSSE on the storage of chemicals

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Storage of flammable goods and gases

Flammable gases, LPG and hydrogen gas: in EI 30 cabinet
(Pragmatic fire engineer thinks that hydrogen gas can be stored together with LPG with a partition or distance.)

Non-combustible gases : oxygen, nitrogen, carbon dioxide, compressed air.

NOTE: Asphyxiating gases such as CO_2 – requires good ventilation

→ Flammable goods: LPG in schools (msb.se, in Swedish)

→ Permits for the handling of flammable gases and liquids (msb.se, in Swedish)

→ Safe and secure school SV(Greater Stockholm fire service)

→ Safe storage of flammable goods, article in KRC's IB 1 2021

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Minium requirements for labelling

Own solutions must be marked with

- name
- hazard pictogram
- pictogram text
- Special info, e.g. about CMR

(Date and name of the person who made the solution may be handy)

The goal is for the user to have the right information.

(AFS 2011:19 SV)

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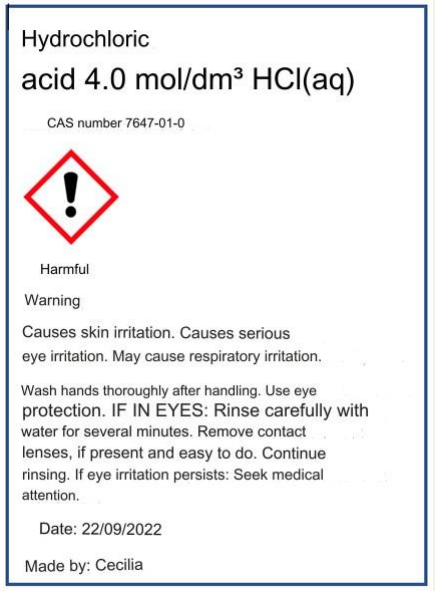
Chemical Safety in Science Education



→ label generator

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Photo: KRC

Additional provisions

Pregnant and lactating women	Special caution → Artikel i KRC:s IB 2022 Nr 2 (in Swedish)
”Phase-out” substances - should not be used	CMR - Carcinogenic, Mutagenic and Reproductive inhibitory. E.g., phenolphthalein, gasoline. Particularly (environmentally) hazardous metals) hazardous metals. E.g., cobalt chloride and lead.
”Priority risk-reduction” substances	Acutely toxic, allergenic and environmentally hazardous E.g., substances. Bromine, heptane , copper sulfate, potassium permanganate

→ CheSSE on restrictions
→ Examples of Phase-out subjects and PRIO subjects (from KRC, in Swedish)

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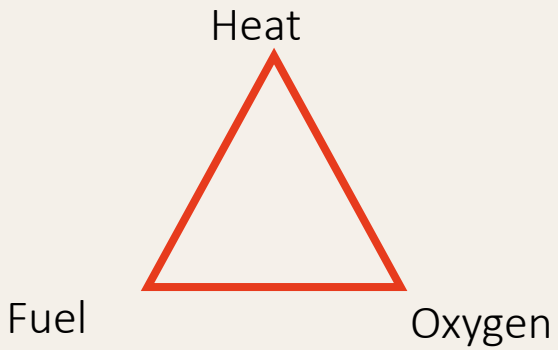
Experiments on fire

→ Acetylene production
→ Gasoline and kerosene
→ Davy lamp
→ Ethanol in a PET bottle
→ Burning powder



Filmed version of acetylene production, LINK

Link to instructions (In Swedish):
https://www.su.se/kemilararnas-resurscentrum/kemisäkerhet/material-från-säkerhetskurser-1.665761

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Times	Content
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15.00	Fika
15.15	Routines, Information and Work Environment
	Distribution of Tasks
16.30	End time

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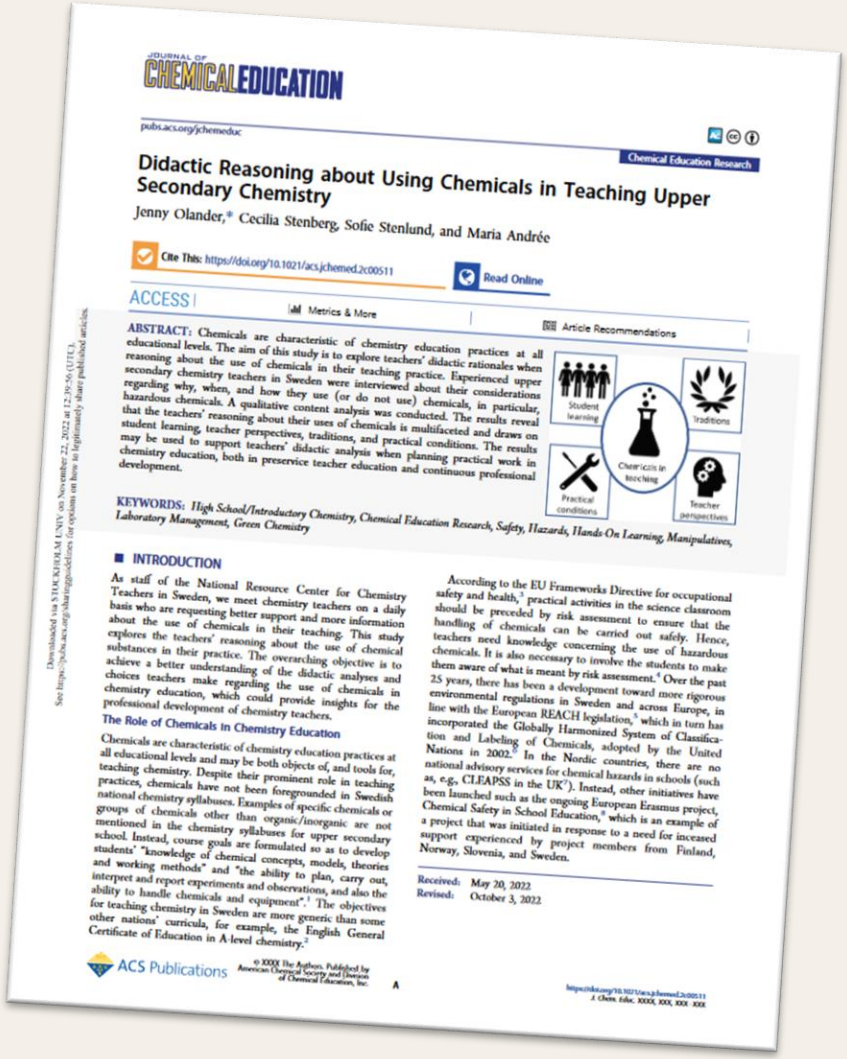
Use of Chemicals in Swedish Schools

- Experienced high school teachers in chemistry/ etc were interviewed
- Why, when and how do you (not) use chemicals?
- What do you think about chemicals that are labeled as dangerous?

"Didactic Reasoning about Using Chemicals in Teaching Upper Secondary Chemistry" (2023), J. Chem. Education. → LINK to full article



JOURNAL OF CHEMICAL EDUCATION

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Chemical Education Research

Didactic Reasoning about Using Chemicals in Teaching Upper Secondary Chemistry

Jenny Olander,* Cecilia Stenberg, Sofie Stenlund, and Maria Andrée

Cite This: https://doi.org/10.1021/acs.jchemed.2c00511 Read Online

ACCESS | Metrics & More | Article Recommendations

ABSTRACT: Chemicals are characteristic of chemistry education practices at all educational levels. The aim of this study is to explore teachers' didactic rationales when reasoning about the use of chemicals in their teaching practice. Experienced upper secondary chemistry teachers in Sweden were interviewed about their considerations regarding why, when, and how they use (or do not use) chemicals, in particular, hazardous chemicals. A qualitative content analysis was conducted. The results reveal that the teachers' reasoning about their uses of chemicals is multifaceted and draws on student learning, teacher perspectives, traditions, and practical conditions. The results may be used to support teachers' didactic analysis when planning practical work in chemistry education, both in preservice teacher education and continuous professional development.

KEYWORDS: *High School/Introductory Chemistry, Chemical Education Research, Safety, Hazards, Hands-On Learning, Manipulatives, Laboratory Management, Green Chemistry*

INTRODUCTION

As staff of the National Resource Center for Chemistry Teachers in Sweden, we meet chemistry teachers on a daily basis who are requesting better support and more information about the use of chemicals in their teaching. This study explores the teachers' reasoning about the use of chemical substances in their practice. The overarching objective is to achieve a better understanding of the didactic analyses and choices teachers make regarding the use of chemicals in chemistry education, which could provide insights for the professional development of chemistry teachers.

The Role of Chemicals in Chemistry Education

Chemicals are characteristic of chemistry education practices at all educational levels and may be both objects of, and tools for, teaching chemistry. Despite their prominent role in teaching practices, chemicals have not been foregrounded in Swedish national chemistry syllabuses. Examples of specific chemicals or groups of chemicals other than organic/inorganic are not mentioned in the chemistry syllabuses for upper secondary school. Instead, course goals are formulated so as to develop students' "knowledge of chemical concepts, models, theories and working methods" and "the ability to plan, carry out, interpret and report experiments and observations, and also the ability to handle chemicals and equipment".[1] The objectives for teaching chemistry in Sweden are more generic than some other nations' curricula, for example, the English General Certificate of Education in A-level chemistry.[2]

According to the EU Frameworks Directive for occupational safety and health,[3] practical activities in the science classroom should be preceded by risk assessment to ensure that the handling of chemicals can be carried out safely. Hence, teachers need knowledge concerning the use of hazardous chemicals. It is also necessary to involve the students to make them aware of what is meant by risk assessment.[4] Over the past 25 years, there has been a development toward more rigorous environmental regulations in Sweden and across Europe, in line with the European REACH legislation,[5] which in turn has incorporated the Globally Harmonized System of Classification and Labeling of Chemicals, adopted by the United Nations in 2002.[6] In the Nordic countries, there are no national advisory services for chemical hazards in schools (such as, e.g., CLEAPSS in the UK[7]). Instead, other initiatives have been launched such as the ongoing European Erasmus project, Chemical Safety in School Education,[8] which is an example of a project that was initiated in response to a need for increased support experienced by project members from Finland, Norway, Slovenia, and Sweden.

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Revised: October 3, 2022

https://doi.org/10.1021/acs.jchemed.2c00511
J. Chem. Educ. XXXX, XXX, XXX−XXX

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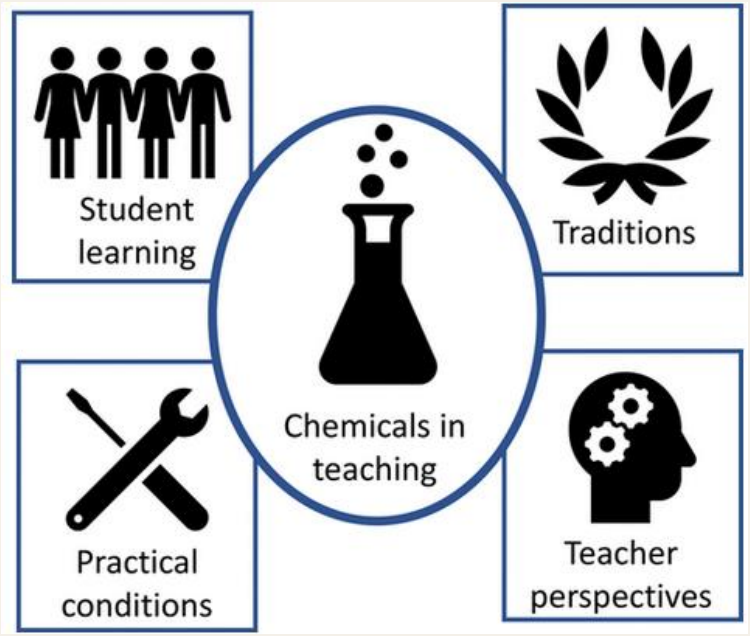
Results from the study

Student learning

- Illustrate concepts and phenomena
- Natural scientific research method
- Handling of hazardous chemicals

Practical conditions

- Organisation
- Collegial decisions about school chemicals



Traditions

- Traditions in chemistry teaching

Teacher perspective

- Teacher strategies
- Knowledge and attitudes regarding dangerous chemicals
- Desire

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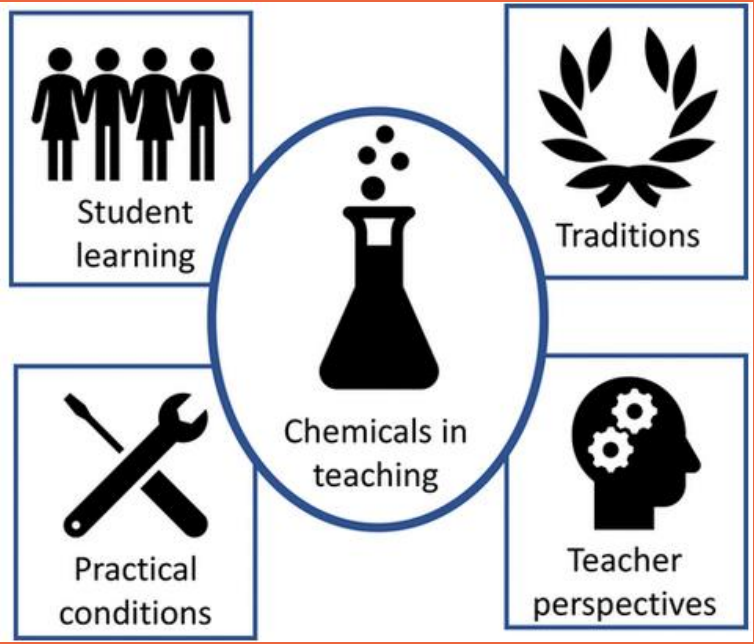

Discussion questions

1. Name any chemicals that you think have a clear purpose in laboratory work. Justify why.
2. When can it be justified to let students use "dangerous" chemicals?

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The risk depends on…

	Simple consequences	Difficult consequences
Low probability	Life	Chance?
High probability	Practice…	Refrain!

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Foto: KRC

Risk assessment according to

- 10§ AFS 2011:19 (amendment AFS 2022:4SV)

The workplace (school) must

- identify *sources of risk* , (chemicals/work elements)
- take protective measures and precautions,
- provide workers (teachers/students) with information about risks
- Have written documentation that is dated, signed and available.
- The change means that the employer must also keep a register of workers who have been exposed to unhealthy levels of reproductive toxic substances. These records must be kept for at least 5 years.

The last part, "notes in the margin", is done by each teacher. These do not need to be saved

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Flame colours

- What do you think stundents can learn from it?

Risk assessment

- What risks are involved with the demonstration?

Link to instrucions (in Swedish)

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What purposes can you have with flame colours?

Systematic examination

Properties of substances

Periodic table

Riskb assessment

Astronomy

Documentation

Fire works

Heating of the salt. It remains!

Demonstration/student work

Method of analysis

Combustion of the ethanol

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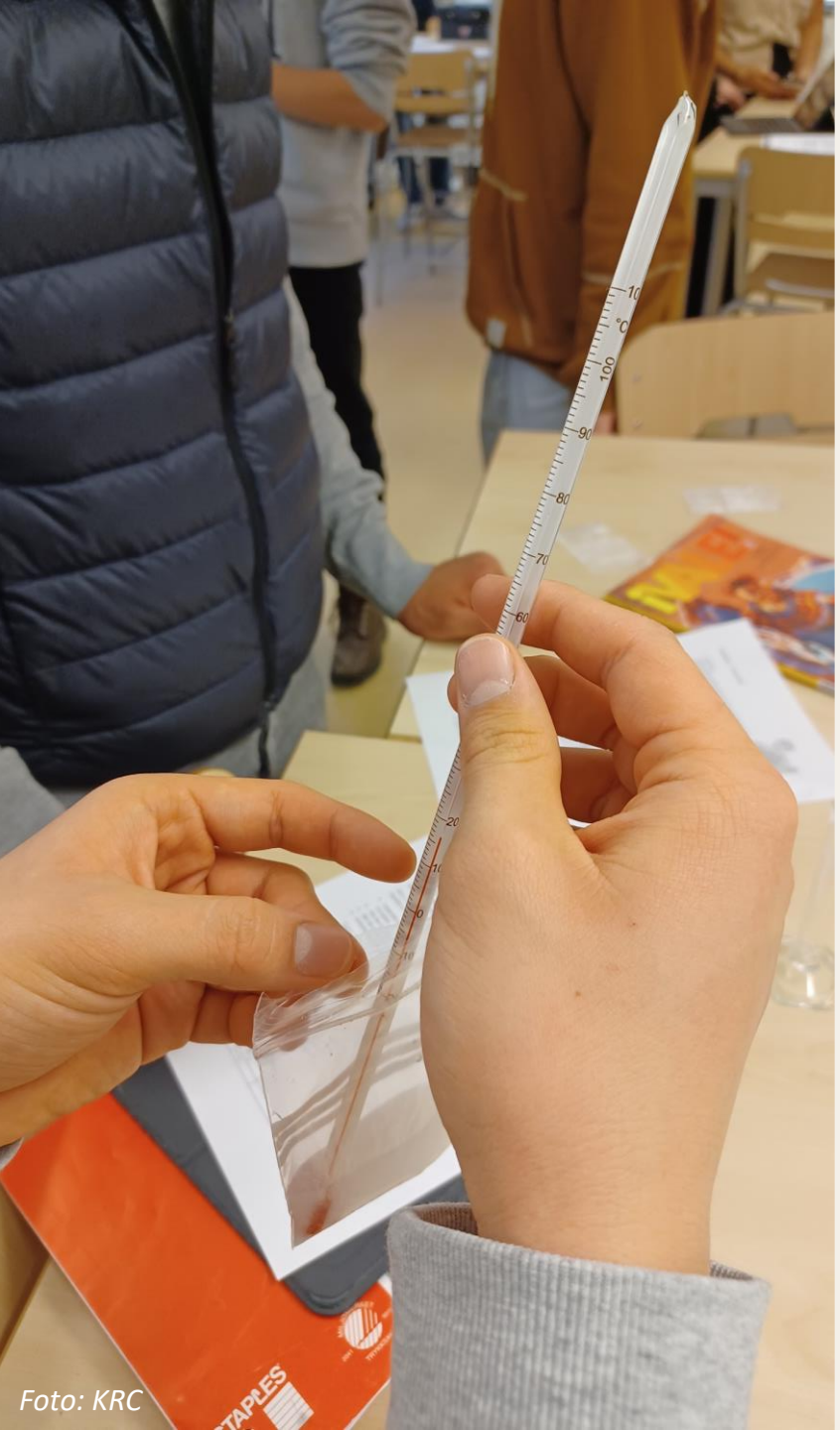

Foto: KRC

Factors affecting risk

- Teacher demonstration or student activity
- The students' experiences, e.g. to boil in test tubes, to handle burners
- Classroom/group size
- Access to protective equipment
- The teacher's experience

What happens if you have done something "wrong" in your risk assessment?

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Risk assessment in school

The risk assessment

- should be useful and accessible.
- could be made starting from other people's templates.
- Could be made in various forms

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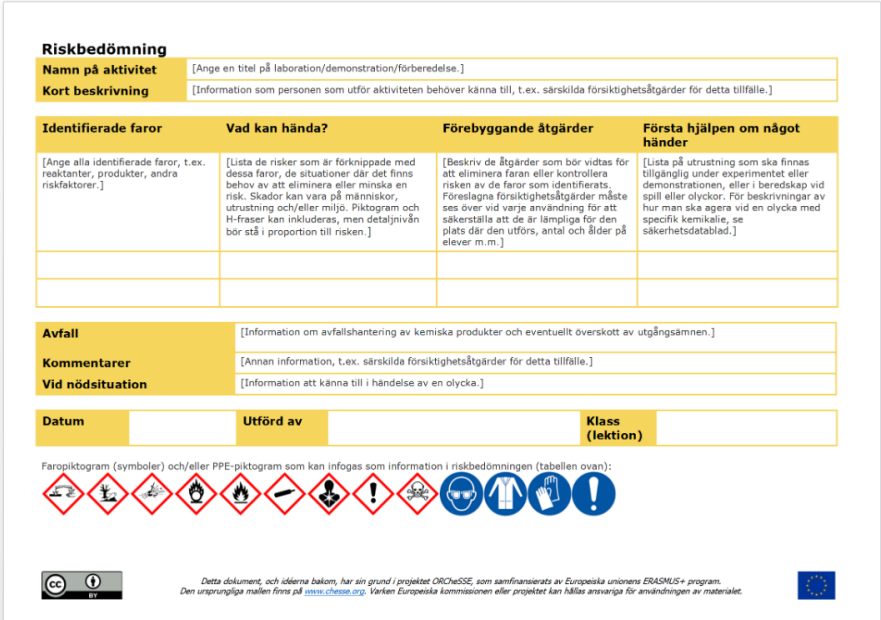
Proposal for overall risk assessment

Can be made for groups of risks.

What risk is assessed?	Protective equipment	Other measures?	Who attends?
Teacher's work with concentrated acids	Coat, goggles, gloves, fume hood	The work must not be carried out alone	Employer Chemistry teacher
Ester synthesis	Lab coat, hair up, safety glasses, fume hood	See separate risk assessment	The NV teachers
Work with burners	Lab coat, hair up	Requirements for a burner driver's license according to Appendix X	Teacher in NV, principal
Replacement of LPG bottles	None in particular	Use leak spray, see routine X	Superintendent of flammable goods

Risk assessment of practicals



Riskbedömning

Namn på aktivitet	[Ange en titel på laboration/demonstration/förberedelse.]
Kort beskrivning	[Information som personen som utför aktiviteten behöver känna till, t.ex. särskilda försiktighetsåtgärder för detta tillfälle.]

Identifierade faror	**Vad kan hända?**	**Förebyggande åtgärder**	**Första hjälpen om något händer**
[Ange alla identifierade faror, t.ex. reaktanter, produkter, andra riskfaktorer.]	[Lista de risker som är förknippade med dessa faror, de situationer där det finns behov av att eliminera eller minska en risk. Skador kan vara på människor, utrustning och/eller miljö. Piktogram och H-fraser kan inkluderas, men detaljnivån bör stå i proportion till risken.]	[Beskriv de åtgärder som bör vidtas för att eliminera faran eller kontrollera risken av de faror som identifierats. Föreslagna försiktighetsåtgärder måste ses över vid varje användning för att säkerställa att de är lämpliga för den plats där den utförs, antal och ålder på elever m.m.]	[Lista på utrustning som ska finnas tillgänglig under experimentet eller demonstrationen, eller i beredskap vid spill eller olyckor. För beskrivningar av hur man ska agera vid en olycka med specifik kemikalie, se säkerhetsdatablad.]

Avfall	[Information om avfallshantering av kemiska produkter och eventuellt överskott av utgångsämnen.]
Kommentarer	[Annan information, t.ex. särskilda försiktighetsåtgärder för detta tillfälle.]
Vid nödsituation	[Information att känna till i händelse av en olycka.]

Datum		**Utförd av**		**Klass (lektion)**	

Faropiktogram (symboler) och/eller PPE-piktogram som kan infogas som information i riskbedömningen (tabellen ovan):

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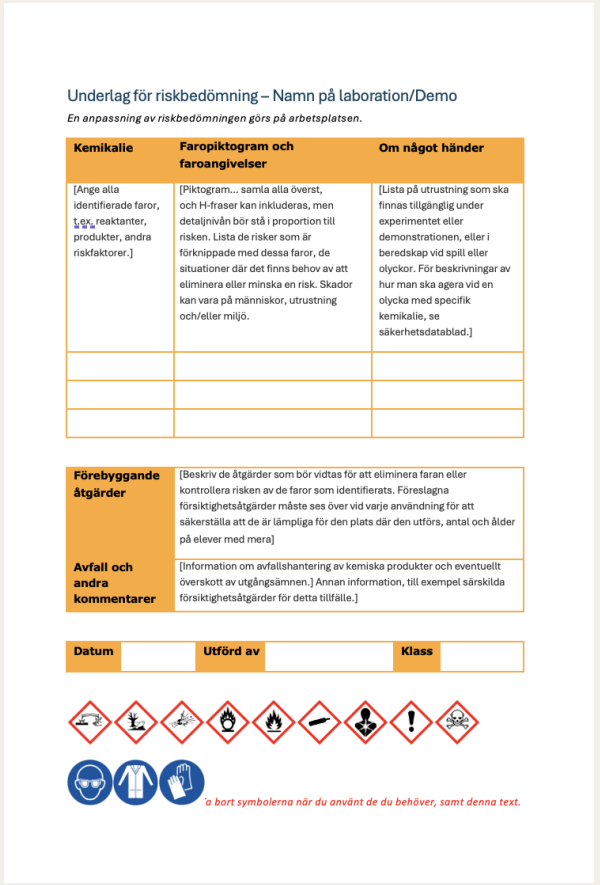
Chemical Safety in Science Education

→ Risk assessment at CheSSE



Underlag för riskbedömning – Namn på laboration/Demo

En anpassning av riskbedömningen görs på arbetsplatsen.

Kemikalie	**Faropiktogram och faroangivelser**	**Om något händer**
[Ange alla identifierade faror, t.ex. reaktanter, produkter, andra riskfaktorer.]	[Piktogram... samla alla överst, och H-fraser kan inkluderas, men detaljnivån bör stå i proportion till risken. Lista de risker som är förknippade med dessa faror, de situationer där det finns behov av att eliminera eller minska en risk. Skador kan vara på människor, utrustning och/eller miljö.	[Lista på utrustning som ska finnas tillgänglig under experimentet eller demonstrationen, eller i beredskap vid spill eller olyckor. För beskrivningar av hur man ska agera vid en olycka med specifik kemikalie, se säkerhetsdatablad.]

Förebyggande åtgärder	[Beskriv de åtgärder som bör vidtas för att eliminera faran eller kontrollera risken av de faror som identifierats. Föreslagna försiktighetsåtgärder måste ses över vid varje användning för att säkerställa att de är lämpliga för den plats där den utförs, antal och ålder på elever med mera]
Avfall och andra kommentarer	[Information om avfallshantering av kemiska produkter och eventuellt överskott av utgångsämnen.] Annan information, till exempel särskilda försiktighetsåtgärder för detta tillfälle.]

Datum		**Utförd av**		**Klass**	

a bort symbolerna när du använt de du behöver, samt denna text.

Template from KRC

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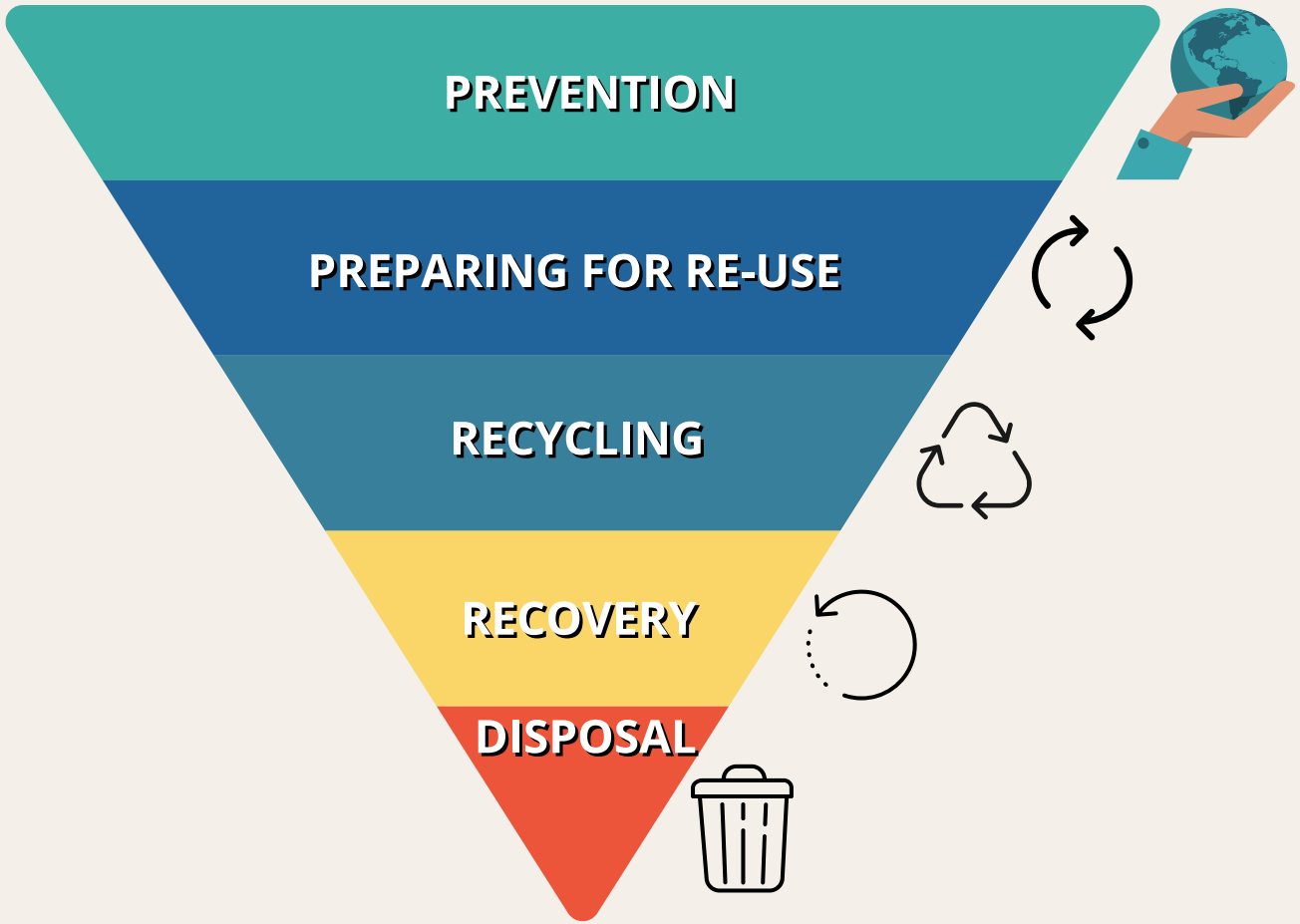
Waste



The Waste Framework Directive defines a hierarchy in waste management. → Waste management

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CheSSE Chemical Safety in Science Education

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Waste containers

	type of hazardous waste	Storage
1	Environmentally hazardous inorganic salts*	Plastic can without lid
2	Organic substances without halogens	Plastic can** with lid in a ventilated area
3	Halogenated organic substances	Plastic can* with a lid in a ventilated area
4	Metal powder (pieces are reused)	Tin container with lid
5a	Regular soda glass (bottles, simple test tubes)	Glass breaker container
5b	Heat-resistant borosilicate glass (e.g Durex)	Crushed glass container (**landfill**)
6	(Mineral acids and bases)	Dilute or neutralize before pouring
7	(Biological hazard waste)	

* The following metal ions can be poured into the slush: Na, K, Li, Ca, Mg

Waste containers must be solvent-resistant vessels. Waste cans are usually made of polypropylene (PP) and polyethylene (PE).

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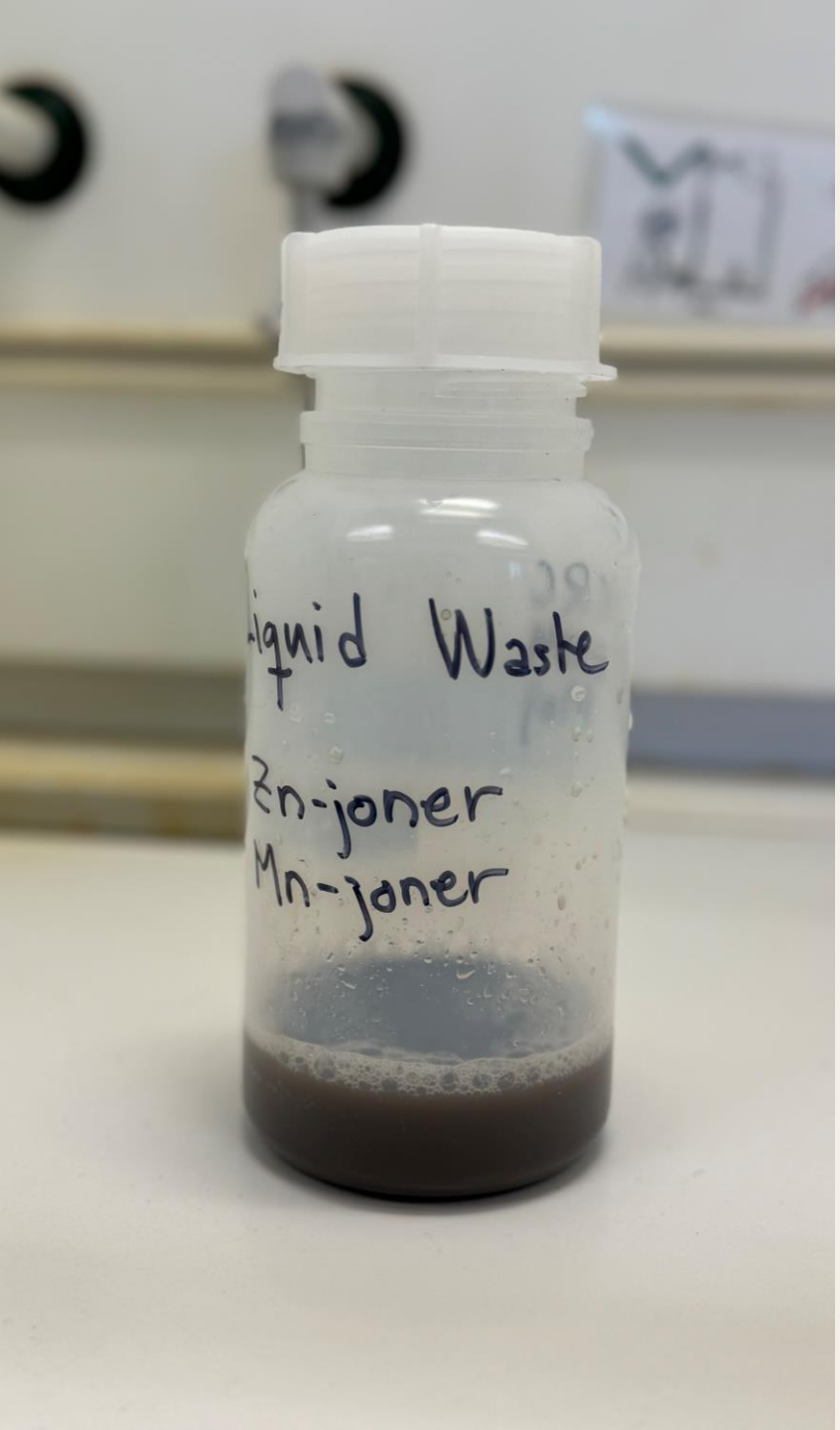

Waste management

- The environmental office in your municipality should be able to answer how the waste should be handled and sorted.
- There may be different regional rules.
- Waste containers must also be clearly marked for appropriate handling and storage
- Have clear procedures in the workplace for waste management.
- How to inform staff and students?
- How often should pick-up take place?

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Discussion questions

1. How have you organized the handling and storage of hazardous waste at your workplace?
2. How is the collection of hazardous waste organized at your workplace?

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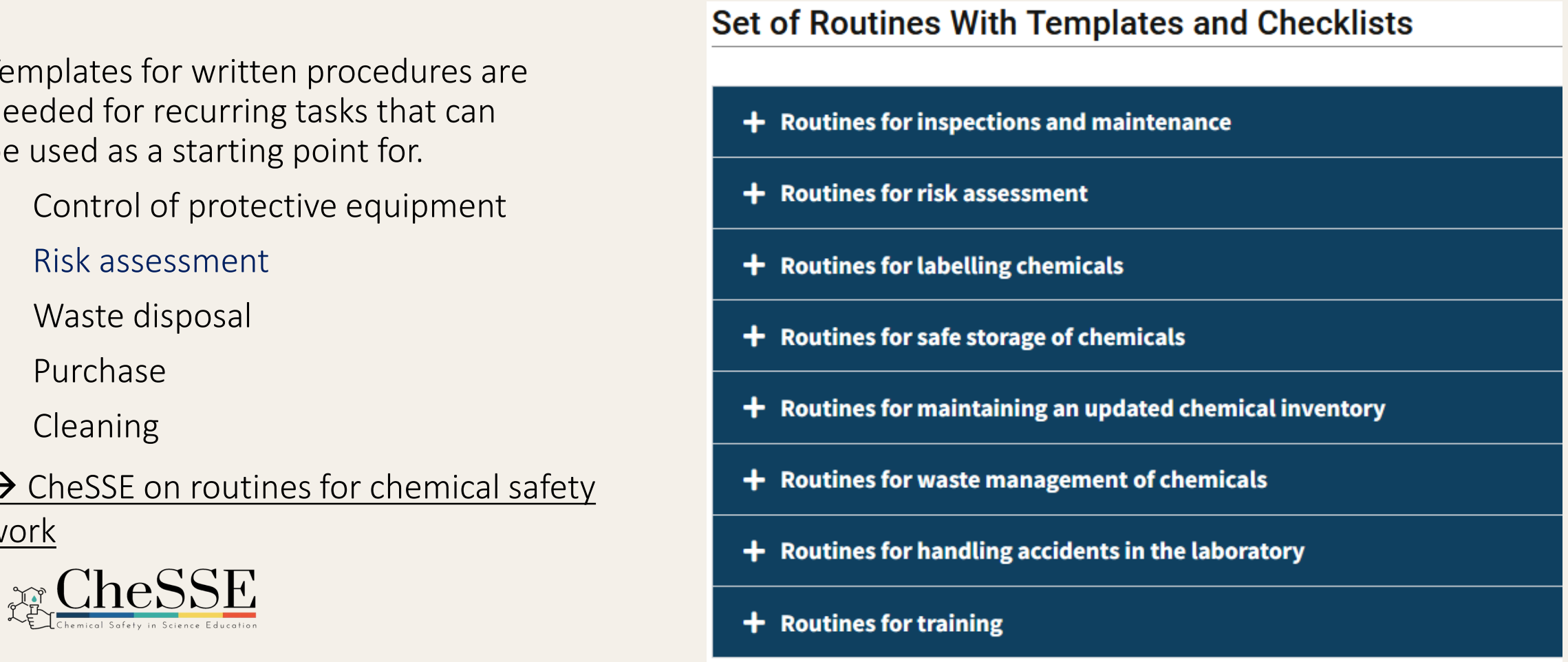
Routines

Templates for written procedures are needed for recurring tasks that can be used as a starting point for.

- Control of protective equipment
- Risk assessment
- Waste disposal
- Purchase
- Cleaning

→ CheSSE on routines for chemical safety work



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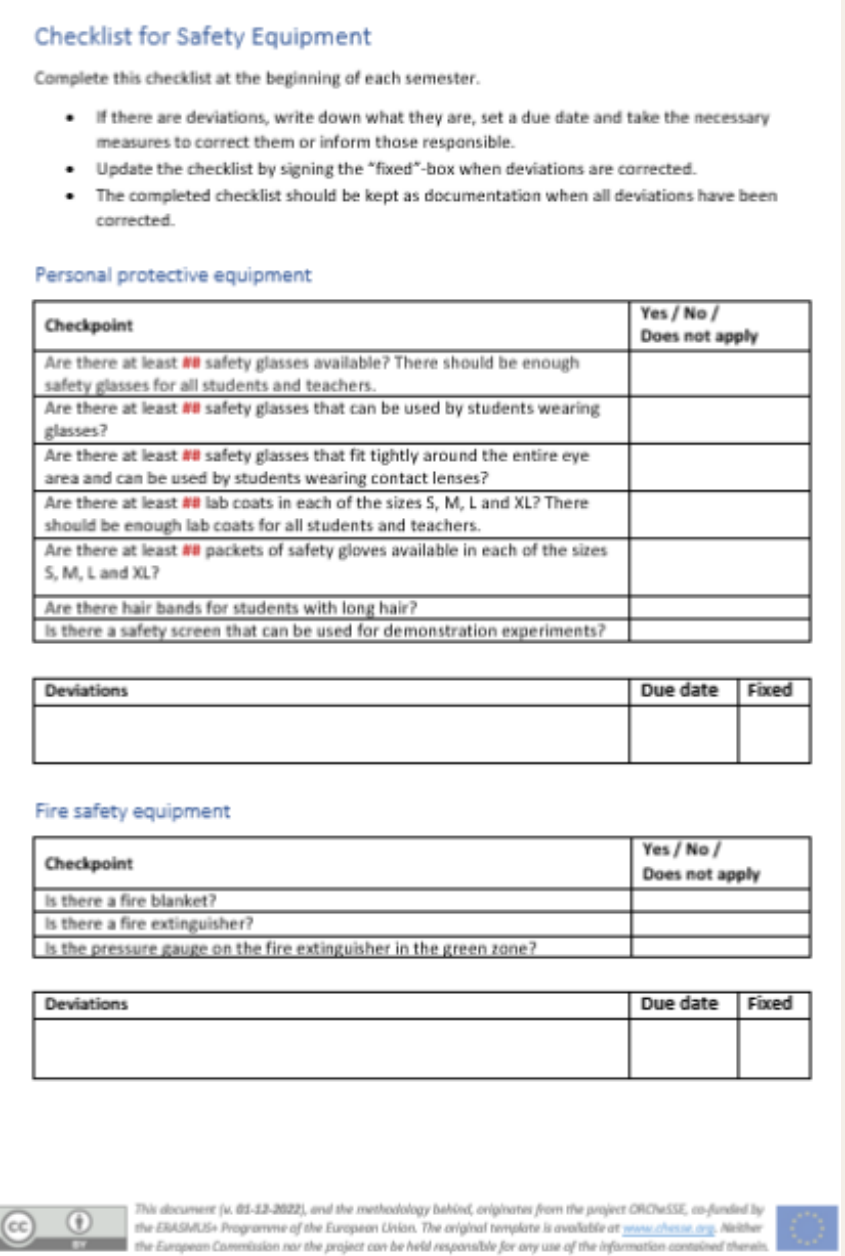

Checklist for Safety Equipment

Complete this checklist at the beginning of each semester.

- If there are deviations, write down what they are, set a due date and take the necessary measures to correct them or inform those responsible.
- Update the checklist by signing the "fixed"-box when deviations are corrected.
- The completed checklist should be kept as documentation when all deviations have been corrected.

Personal protective equipment

Checkpoint	Yes / No / Does not apply
Are there at least ## safety glasses available? There should be enough safety glasses for all students and teachers.	
Are there at least ## safety glasses that can be used by students wearing glasses?	
Are there at least ## safety glasses that fit tightly around the entire eye area and can be used by students wearing contact lenses?	
Are there at least ## lab coats in each of the sizes S, M, L and XL? There should be enough lab coats for all students and teachers.	
Are there at least ## packets of safety gloves available in each of the sizes S, M, L and XL?	
Are there hair bands for students with long hair?	
Is there a safety screen that can be used for demonstration experiments?	

Deviations	Due date	Fixed

Fire safety equipment

Checkpoint	Yes / No / Does not apply
Is there a fire blanket?	
Is there a fire extinguisher?	
Is the pressure gauge on the fire extinguisher in the green zone?	

Deviations	Due date	Fixed

Checklists

- Is the necessary equipment available?
- What needs to be checked?
- How often? By who?
- Security patrols - security agents

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Chemical Safety in Science Education

→ Checklists and tools

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Information to students and colleagues

- Template: Routines for student training in chemical safety (Word)
- Example: Safety rules for the science classroom (Word)
- Example: Detailed safety rules for the chemistry classroom (Word)
- Template: Gas burner instructions (Word)
- Template: Gas burner certificate (PowerPoint)
- Template: Information for students and guardians (Word)

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→ Information

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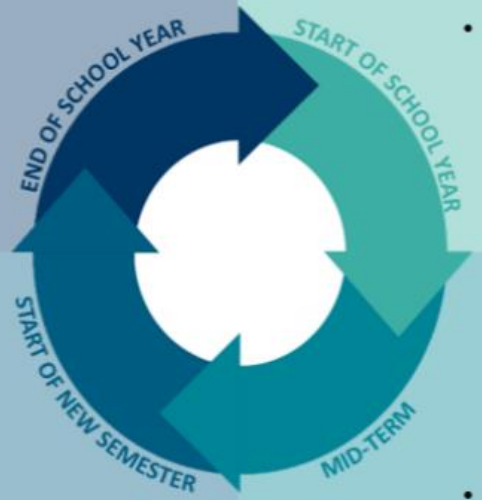
YEAR WHEEL FOR CHEMICAL SAFETY

- Dispose of hazardous waste
- Review risk assessments
- ...

- Inspect the science department
- Inspect safety equipment
- ...



- Inspect safety equipment
- Annual inspection of fume hoods/cupboards
- ...

- Inspect stored chemicals
- ...

The Year Wheel is updated to the needs of each work place.

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→ Checklists and tools

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What is included in the tasks of a chemistry/Science teacher?

From Flickr.com

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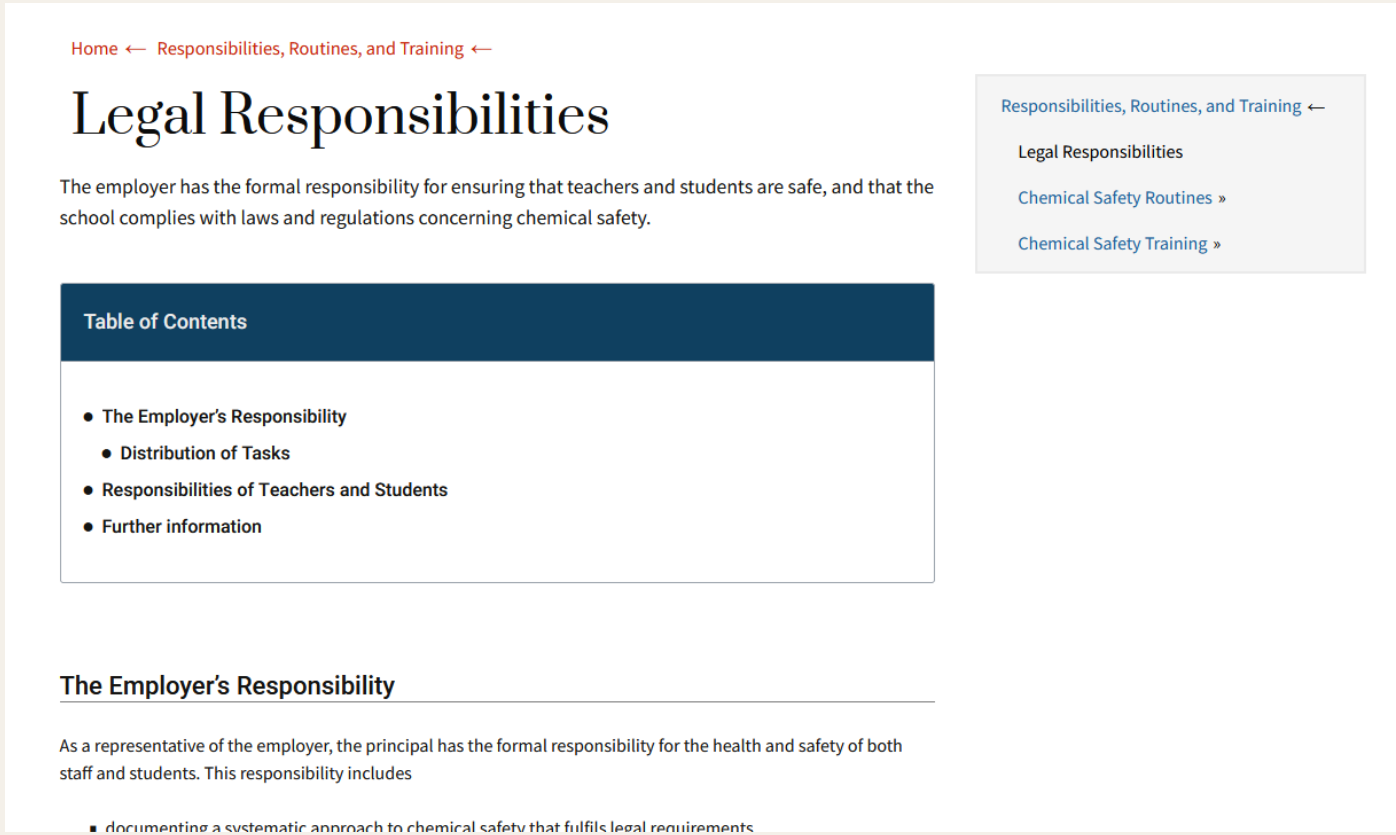
Distribution of tasks



Home ← Responsibilities, Routines, and Training ←

Legal Responsibilities

The employer has the formal responsibility for ensuring that teachers and students are safe, and that the school complies with laws and regulations concerning chemical safety.

Responsibilities, Routines, and Training ←

Legal Responsibilities

Chemical Safety Routines »

Chemical Safety Training »

Table of Contents

- The Employer's Responsibility
  - Distribution of Tasks
- Responsibilities of Teachers and Students
- Further information

The Employer's Responsibility

As a representative of the employer, the principal has the formal responsibility for the health and safety of both staff and students. This responsibility includes

- documenting a systematic approach to chemical safety that fulfils legal requirements

→ Legal responsabilities

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CheSSE Chemical Safety in Science Education

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Systematic Work Environment Management

The Employer must	The Worker (teacher) must
take necessary measures to prevent ill-health and accidents.	observe caution to prevent ill health and accidents.
ensure that written routines are in place and that annual follow-ups are carried out in the SAM work.	know and follow given regulations and use protective equipment provided by the employer.
take into account the special conditions of minors.	know that students in education are equated with employees in many respects.

From Systematic Work Environment Management (SAM), AFS 2001:1

SWEDISH WORK ENVIRONMENT AUTHORITY

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Continuation - Systematic Work Environment Management

The Employer must	The Worker (teacher) must
inform the employees about the risks in the work, and about protection and handling instructions.	report to the employer if the work involves immediate danger.
distribute the work environment work in writing and give powers and resources to those concerned.	carry out the assigned tasks or inform the employer (principal) if this is not possible.

From Systematic Work Environment Management (SAM), AFS 2001:1

If sufficient resources are lacking, the employer must be contacted to prioritize tasks, according to “Organizational and social work environment)” AFS 2015:4

SWEDISH WORK ENVIRONMENT AUTHORITY

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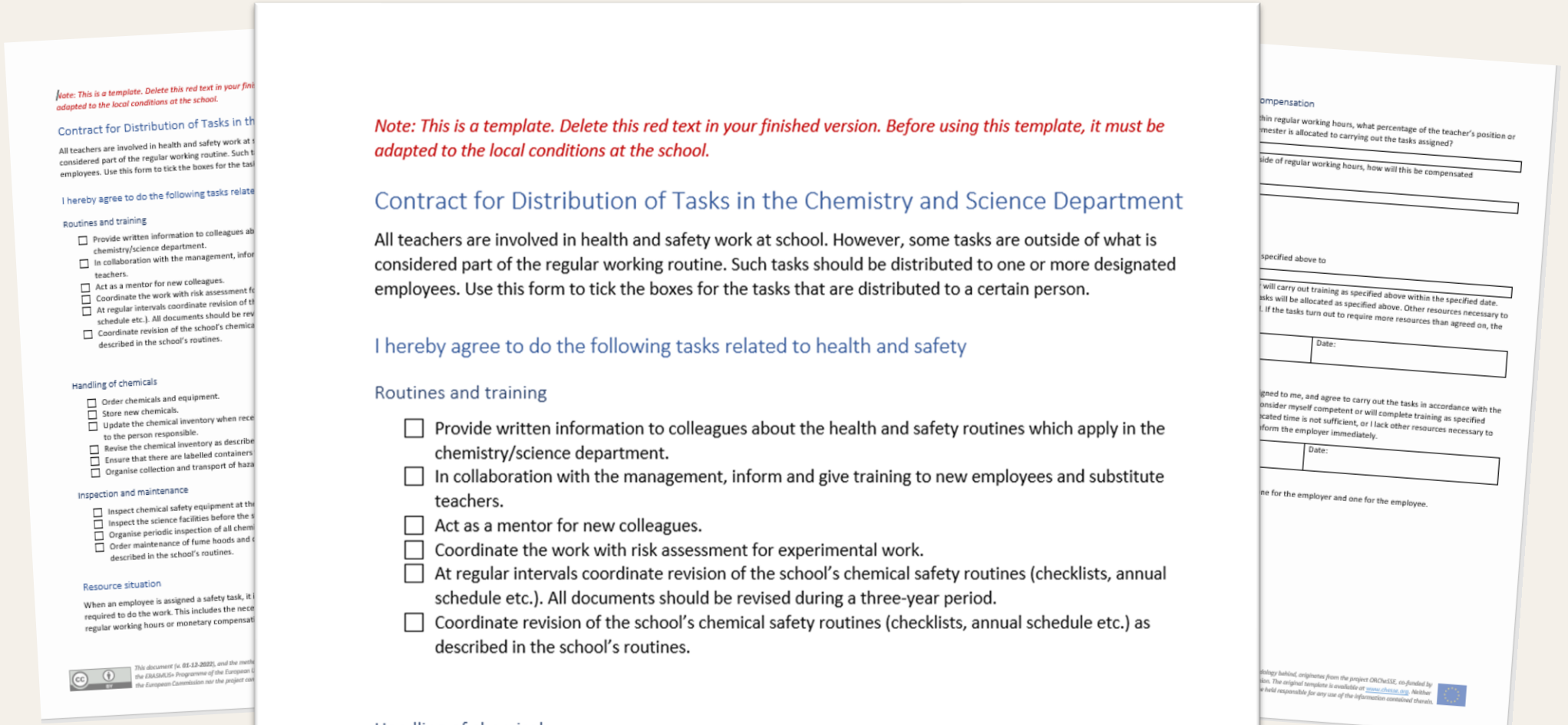
Contract for Distribution of Tasks – an example



Note: This is a template. Delete this red text in your finished version. Before using this template, it must be adapted to the local conditions at the school.

Contract for Distribution of Tasks in the Chemistry and Science Department

All teachers are involved in health and safety work at school. However, some tasks are outside of what is considered part of the regular working routine. Such tasks should be distributed to one or more designated employees. Use this form to tick the boxes for the tasks that are distributed to a certain person.

I hereby agree to do the following tasks related to health and safety

Routines and training

- ☐ Provide written information to colleagues about the health and safety routines which apply in the chemistry/science department.
- ☐ In collaboration with the management, inform and give training to new employees and substitute teachers.
- ☐ Act as a mentor for new colleagues.
- ☐ Coordinate the work with risk assessment for experimental work.
- ☐ At regular intervals coordinate revision of the school's chemical safety routines (checklists, annual schedule etc.). All documents should be revised during a three-year period.
- ☐ Coordinate revision of the school's chemical safety routines (checklists, annual schedule etc.) as described in the school's routines.

Handling of chemicals

- ☐ Order chemicals and equipment.
- ☐ Store new chemicals.
- ☐ Update the chemical inventory when receiving a new safety data sheet or hand the safety data sheet to the person responsible.
- ☐ Revise the chemical inventory as described in the school's routines.

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In which bottles and cabinets should the chemicals be stored?

How often should emergency showers and eyewashes be checked?

Do chemicals get old? When should they be discarded?

What can (not) be poured down the sink?

Image by brgfx on Freepik

Is it ok to only have safety data sheets online or do they have to be in paper form?

How should tasks be distributed?

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Safety in Biology education

- Chemicals in Biology: KRC's Guidelines and Advice (Collaboration)
- Bioresurs works with three areas:

1. Laboratory work with microorganisms and genetically modified microorganisms
   (infection risks, sterile technology, waste management)
2. Animals in education
   (dissection material, animal experiments)
3. Blood Laboratory Exercises in Teaching
   (infection risks, advice and rules)

[National Resource Center for Biology teaching (bioresurs.uu.se)]

Other events for chemistry teachers in Sweden

→ Zoom with a PhD student in chemistry – for upper secondary schools LINK

→ Diploma work togehter with metals industry LINK

EOES
European Olympiad of Experimental Science

Åk 7-9/Gy: → EOES

SVENSKA NATIONAL-KOMMITTÉN FÖR KEMI

→ Experimental Chemsitry, August 12th – 16th, Skellefteå

→ Nordic Chemistry Learning Conference, Stockholm September, 23-24, 2024.

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SEPTEMBER
UTBILDNING

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Lärarfortbildning om kemisimuleringar

Gymnasielärare i kemi och naturkunskap bjuds in till fortbildning under hösten 2024.

→ Professional development about simulations in chemistry education

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OKTOBER

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Explosiva blandningar i Umeå

Vi genomför ett antal demonstrationer och diskuterar hur de kan användas i kemiundervisningen.

→ Course day about explosives in chemistry teaching

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Times	Content
9.00	Chemicals Legislation
10.00	Fika
10.15	Chemical Inventory List and Substitution
11.15	Storage – Labelling - Waste
12.00	Lunch
13.00	Practical Task
14.15	Risk Assessment
15.00	Fika
15.15	Routines, Information and Work Environment
	Distribution of Tasks
16.30	End time

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Thanks for today!

Jenny

Evaluation
https://survey.su.se/Survey/54200

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