

# Storage of Hazardous Materials

Guideline for Practice

Revised Edition 2018





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## Guideline for Practice

Published by the Environment Offices of the cantons of North West Switzerland (Aargau, Basel-Landschaft, Basel-Stadt, Bern, Solothurn), the cantons Thurgau and Zurich as well as the Building Insurance Company of the State of Zurich (BIC).

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# Legal Significance of this Publication

This guideline originally came into existence on the initiative of the Environmental Protection Commission of North-West Switzerland. It is the result of an interdisciplinary cooperation of several cantonal environment offices (AG, BE, BL, BS, SO, TG, ZH), the Zurich Building Insurance Association (GVZ), the Swiss Safety Center AG (formerly Swissi AG) and the Federal Office for the Environment (FOEN). The guideline is intended as a comprehensive overview of the most important safety-relevant aspects for the storage of hazardous materials and should therefore enable better recognition of hazardous materials, optimisation of their storage and initiation of the necessary safety measures. The guideline takes the present valid legal regulations and current state of the art of safety technology into consideration. The information and recommendations are based on meticulous research. Nevertheless, no guarantee can be provided for their correctness and completeness. All liability is expressly excluded. In particular, this guideline does not absolve the owners and operators of hazardous materials stores from their obligation to obtain further clarification within the scope of their personal responsibility. The guideline does not replace legal regulations, it is merely a summary of existing specifications and recommendations for practice. Following these recommendations will provide a certain legal security for lawful conduct. This guideline should also enable the enforcement authorities to exercise a harmonized enforcement policy nation-wide. Abbreviations are explained in section 11.2.

## Edition notice

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The translation into English  
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In case of differences or  
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	Supplement 2: Joint storage tables	enclosed
	Supplement 3: Canton-specific supplement (if available)	enclosed

# 1 Validity and Purpose

1

This guideline provides information about relevant issues (legal, constructional, safety-technical and organisational) for the design and operation of a store for hazardous materials and preparations (mixtures). It deals with the storage of hazardous materials and preparations (solid, liquid and gaseous) in packagings such as barrels, bottles and sacks (see also section 3.7).



(Photo source: Environment Office, Ct. TG)



(Photo source: Carbagas AG, Gümligen BE)

Not all of the storage classes listed in this guideline are always found in individual branches and small stores. Nevertheless, the operator of a store is recommended to study the complete guideline because different measures are required depending on the type and quantity of the stored goods.

## Definition of hazardous materials

Hazardous **materials** in the sense of this guideline are materials, preparations (mixtures) and objects (solid, liquid or gaseous) which have one or more dangerous properties and can therefore endanger the life and health of persons and animals, pollute the environment or cause material damage.

Unfortunately, the vast number of different national and international regulations and standards often lead to uncertainties regarding the used terminology. Whilst chemicals law refers to substances and mixtures with dangerous properties, industrial health and safety frequently refers to hazardous materials. The term hazardous goods is a transport term (road, rail, sea, air). Generally, however, the dangerous nature of a substance, mixture or object is always paraphrased.

**For the sake of simplicity, the term «hazardous materials» will be used exclusively below!**

## Definition of storage

**Storage** in the sense of this guideline is the keeping of hazardous materials in closed packagings and containers for use company-internally or for transport or dispensing to third parties. The storage duration in a store is longer than 8 hours as a rule.

Short-term provision for a production process or for delivery or temporary "parking" after delivery is not classed as storage. However, in these cases too, reasonable safety precautions must be taken.

## Validity

The guideline does not apply for the use or processing of hazardous materials or for storage in stationary tanks and silos or in sales rooms. Other extended regulations, which this guideline does not cover or only partly covers, apply for special stores with hazardous materials as well as for companies of the chemical industry and chemical wholesalers. Special legal storage regulations apply for the storage of special substances such as explosives, infectious materials and radioactive materials (storage classes 1, 6.2 and 7). These are not dealt with in this guideline. Additional aspects of the Major Accidents Ordinance may have to be considered for larger storage quantities.

## 2 Introduction

We encounter hazardous materials in many areas of our daily lives. Hazardous materials must often be stored as raw and auxiliary materials for the production of goods and for use in industrial and commercial enterprises. Improper storage of such materials can present various hazards for man, the environment and property.

Potential hazards	Effects
<b>Fire/explosion</b>	Release of toxic gases and vapours, explosions, secondary reactions, contamination of ground, ground water and surface waters by contaminated fire fighting water
<b>Floods</b>	Environmental pollution by contaminated water
<b>Leakages or improper disposal</b>	Spreading of toxic and environmentally harmful materials

The operators of stores and transshipment points for hazardous materials are responsible for ensuring that the necessary state-of-the-art constructional, technical and organisational measures are taken. Hazards often only occur in contact with other materials. The joint storage of different hazardous materials is therefore also subject to special care and attention.

The correct storage of hazardous materials must always consider the following points:

<b>Basic principle of risk minimisation</b>	Plan, build and operate stores for hazardous materials so that the risks for persons, environment and property are minimised.
<b>Legal regulations</b>	The legal regulations and requirements must be satisfied.
<b>State of the art</b>	The state of the art with regard to work safety, fire protection, water protection, air hygiene, accident prevention as well as safety and factory security must be observed.

A major problem is that many employees are not aware what materials are «hazardous», what «storage» actually means and what regulations need to be observed in particular. The persons responsible therefore inherit a considerable liability risk.

The problem is further complicated by the fact that there are no fully comprehensive legal regulations regarding storage, classification and labelling of hazardous materials and their handling. What does exist is a multitude of different regulations with contents relevant to storage which cover the areas of water protection, fire protection, chemical law, occupational health and safety, accident prevention and waste as well as legal construction regulations or transport regulations within the scope of road, railway, shipping and aviation legislation which often overlap so that it is difficult to get a clear overall picture.

This guideline summarises and describes the most important legal regulations. The authors expressly point out that the detailed regulations from the individual technical areas would burst the boundaries of this guideline. The individual original regulations are referred to quite clearly in this context (see section 10).

## 2 Introduction

### 2.1 Examples of Hazardous Reactions

- **Hydrogen** is a highly explosive gas that forms explosive mixtures with air, oxygen or chlorine. It occurs when **non-precious metals** (e.g. aluminium, zinc, nickel, iron) are exposed to acids or when **water** or moisture comes into contact with **alkaline metals** (e.g. sodium, potassium) or **alkalis** with e.g. aluminium.
- Toxic, nitrous gases are formed when **nitric acid** comes into contact with sawdust, wood shavings, polishing wool, paper, cotton waste, cellulose or other finely distributed organic materials. Fires, spontaneous combustion or even explosions are possible depending on the basic conditions.
- **Strong oxidants** such as concentrated **hydrogen peroxide** can cause fires when they come into contact with **organic materials** such as wood, paper, cardboard, etc. Hydrogen peroxide can lead to violent explosive decomposition reactions in contact with organic chemicals (e.g. formic acid).
- **Hydrogen cyanide** (prussic acid) is highly inflammable as a gas and is highly toxic if inhaled. It is produced, for example, when **cyanide compounds come into contact** with **acid**.
- **Hydrogen sulphide** is an extremely toxic, highly inflammable gas which forms an explosive mixture with air. Toxic gas mixtures are formed mainly when **sulphides** are exposed to **acid**.
- **Concentrated sulphuric acid**, when mixed with **concentrated sodium hydroxide solution**, generates such strong heat (exothermic reaction) that it can boil over or fling off corrosive liquid.
- Toxic chlorine gas is formed when **Javelle water** (disinfectant in water treatment) comes into contact with **acids**.

#### Overview of frequently occurring dangerous reactions

Material A	+	Material B	=	Hazard
Acids	+	Metals	=	<b>Spontaneous combustion (hydrogen gas)</b>
Oxidants	+	Organic materials	=	<b>Fire, explosion</b>
Cyanides	+	Acids	=	<b>Toxic hydrogen cyanide gas</b>
Sulphides	+	Acids	=	<b>Toxic hydrogen sulphide gas</b>
Alkaline metals	+	Water	=	<b>Spontaneous combustion (hydrogen gas)</b>
Carbides	+	Water	=	<b>Highly inflammable (acetylene gas)</b>
Acids	+	Alkalis	=	<b>Exothermic reaction (releases heat)</b>
Metal powders	+	Watery solutions	=	<b>Spontaneous combustion (hydrogen gas)</b>
Metal powders	+	Air	=	<b>Spontaneous combustion</b>
Nitric acid	+	Organic materials or metals	=	<b>Toxic, nitrous gases</b>
Javelle water	+	Acids	=	<b>Toxic chlorine gas</b>

## 3 Setting Up a Store

### 3.1 Store Concept

Conscientious study of the complete guideline is a prerequisite for compiling a comprehensive store concept. Certain sections are less important for simple store conditions (e.g. storage of one oil barrel).

A store concept contains all the relevant data for safe storage of hazardous materials in accordance with the rules. It gives the owner an overview of the local conditions and planned measures. The following goals can be achieved with the compilation of a store concept:

- Optimum adaptation of the local conditions and measures to the hazard potential of the materials to be stored.
- Recognition and adaptation, if necessary, of contradictory measures by an overall view of the modus operandi.
- Compliance with legal regulations.
- A sound evaluation basis for the cantonal authorities to grant planning or operating permission (see section 3.2).

In order to achieve these goals, a store concept must contain the information listed below (the appropriate sections of this guideline are listed in brackets):

- A description of the local conditions such as the vicinity of the store, store rooms, type of storage as well as a definition of the types of containers to be stored (section 3).
- The type and quantity of the hazardous materials to be stored (sections 4, 5 and 6).
- The constructional, technical and organisational measures (sections 7, 8 and 9).

The step by step procedure for compiling a store concept is described in section 12. The check list in section 13 can be used to check the store concept.

### 3.2 Application and Permission

Buildings and installations may only be erected and modified with the permission of the responsible authorities. Changes in utilisation, i.e. re-purposing of existing rooms or of whole buildings for the storage of chemicals, also require permission.

In order to obtain permission, the builder must submit an application with the necessary documents (specified on the permission forms) to the responsible authorities. Permission is granted if the project satisfies the valid Federal, cantonal and communal conditions. These include the various building regulations imposed by the community in which the building is located.

The following regulatory areas and authorities must be involved in the considerations depending on the type and quantity of the stored goods:

#### **Fire protection**

The chemicals and fire protection specialists of the responsible fire protection office assess the planned fire protection measures of a building project based on the VKF (Association of Fire Insurance) fire protection regulations. They determine the necessary constructional, technical and organisational fire protection measures and usually also the maximum permissible storage quantities based on the type and quantity of the stored hazardous materials.

## 3 Setting Up a Store

### 3.2 Application and Permission

#### **Water protection**

Water protection is governed by federal, cantonal and communal regulations. During the permission process, the responsible offices mainly emphasise the measures for prevention of water contamination (e.g. retention and collection devices, fire fighting water retention). Storage quantities above 450 litres are subject to compulsory registration. The storage of water-hazardous materials in ground water zones S1 and S2 is prohibited. Storage in the ground water zone S3 always requires the permission of the cantonal authorities.

#### **Employee protection/environmental protection**

Depending on the type and quantity of the stored hazardous materials, the authorities may impose further constraints in the areas of work safety, accident prevention, environmental compatibility testing, air pollution control and chemical safety within the scope of the building permission and/or necessary operating permission.

### 3.3 Store Environment

The environment can have a great influence on the storage risk. The following points must be considered and assessed:

#### **Stores in work rooms and sales rooms**

The quantities of hazardous materials in work rooms and sales rooms must be limited to the daily requirement. This is based on an undisturbed and safe operating/work procedure.

#### **Adjacent rooms**

To prevent fires from spreading to adjacent rooms or from adjacent rooms to the store room, this must be constructed as a fire section (see the VKF (Association of Fire Insurance) fire protection regulations for details).

#### **Protection and safety distances**

Protection and safety distances prevent fires from spreading to adjacent buildings or parts of the store. A prerequisite is that no inflammable materials are stored or placed in these areas (see VKF (Association of Fire Insurance) fire protection regulations for details).

#### **Neighbouring companies**

An incident in a neighbouring company may not have negative effects on one's own stores (e.g. take safety distances and construction into consideration).

#### **Ground drains**

Ground drains in the vicinity must be sealed or protected by other suitable means to prevent materials or contaminated fire fighting water from flowing uncontrolled into the drain system in case of an incident.

#### **Unauthorised access**

Unauthorised access to a hazardous materials store must be prevented or restricted by suitable precautions (lockable rooms, fences, etc.).

#### **Natural hazards**

Lightning strikes can cause fires to break out; lightning protection systems are therefore prescribed for many uses. These prevent fires from breaking out when storage areas are struck by lightning. Storage containers with highly inflammable liquids standing outdoors, for example, must be equipped with a lightning protection system. The responsible fire protection office can provide information about the obligation to install a lightning protection system as well as the planning, execution and inspection of such.

Floods which penetrate storage areas can destroy containers or release hazardous materials. Escaping storage goods and contaminated water can cause considerable environmental damage. Protection against floods is therefore very important.

## 3 Setting Up a Store

### 3.4 Store Rooms

It is recommended to locate store rooms in peripheral areas of company activity if possible. Hazardous materials stores must be located above the highest ground water level and be flood-protected. Liquids must be prevented from seeping into the ground, into other rooms and into the sewer system. All rooms must therefore be liquid-tight and must be equipped with retention devices (thresholds, ponds, etc.). Existing floor drains must be properly closed. Connection to a fire fighting water retention system must be considered (except for gases which are not soluble in water) depending on the type and quantity of the hazardous materials.



Flood protection for chemical stores  
(Photo source: Environment Office, Ct. TG)



Spillage/fire fighting water retention  
(Photo source: Environment Office, Ct. TG)

As a rule, stores must be constructed as fire sections and designed, if possible, so that they are accessible to the fire brigade from two sides.

Store rooms and work rooms must be clearly separated. If dangerous materials are also filled or refilled in a store room, the store room must also be classed as a work room. In this case, such a room must additionally meet the requirements for a work room in addition to those for a store room. Further measures (e.g. in the explosion protection area) may be necessary depending on the type of hazardous materials.

Packagings, external packagings and pallets are necessary for the safe transport of hazardous goods. However, these auxiliary materials must be removed from the store room if they are not needed for transport and stable storage.

### 3.5 Outdoor Storage

Special regulations apply for outdoor storage. The basic requirements usually include firm, liquid-tight flooring as a storage surface, sufficient retention facilities for escaping stored goods, observance of the necessary safety distances and roofing.

Connection to a fire fighting water retention system is also necessary as of a certain quantity of hazardous materials. The responsible environment offices can provide detailed information.

Protection against unauthorised access (fencing, access control) and water protection (drainage of the traffic and transshipment area) must be considered especially for outdoor storage.

Generally, stores for un-cleaned empty containers must be treated identically to stores for full containers (see section 3.7 «Type and Size of Containers» under «Empty containers»). Retention volumes can be dispensed with, however.

## 3 Setting Up a Store

### 3.6 Type of Storage

Hazardous materials are stored in different ways, usually in shelf storage or block storage. As long as the stores are small, this has no significant influence on fires and accidents. However, the greater the storage quantities, the more the type of storage affects an incident.

The type of storage has a direct influence on possible safety measures. The overview below lists the following special measures depending on the type of storage:

Type of storage	Special hazards	Special measures
<b>Shelf store</b>	<ul style="list-style-type: none"> <li>• Very big influence of the packaging (wooden pallets, boxes, foils)</li> <li>• Individual storage place is not easily accessible</li> <li>• Chimney effect causes fire to spread faster</li> </ul>	<ul style="list-style-type: none"> <li>• Stricter requirements apply from a storage height of 7.5 m (high-shelf store) (a fire extinguishing system may be necessary)</li> </ul>
<b>Block store</b>	<ul style="list-style-type: none"> <li>• The source of the fire is usually not accessible</li> <li>• Danger of collapse of high blocks</li> </ul>	<ul style="list-style-type: none"> <li>• Formation of partial storage areas of max. 100 m<sup>2</sup></li> <li>• Minimum distances between the blocks 2.5 m</li> <li>• Block store width max. 4 pallets</li> <li>• Block store height max. 6 m</li> </ul>
<b>Bottle store (gases, aerosols)</b>	<ul style="list-style-type: none"> <li>• Danger of bursting pressurised containers, especially due to heat</li> <li>• Spreading of fire by flying bottles or cans</li> <li>• Spreading of gas</li> </ul>	<ul style="list-style-type: none"> <li>• Storage outdoors or in separate fire section</li> <li>• Ventilation concept</li> <li>• Possibly gas warning system</li> <li>• Possibly fire extinguishing system</li> <li>• Explosion protection</li> </ul>
<b>Refrigerated storage (gases)</b>	<ul style="list-style-type: none"> <li>• Danger of freezing</li> <li>• Danger of suffocation</li> <li>• Spreading of gas</li> <li>• Danger of explosion</li> <li>• Heat insulation</li> </ul>	<ul style="list-style-type: none"> <li>• Temperature monitoring</li> <li>• Storage in separate fire section</li> <li>• Ventilation concept</li> <li>• Explosion protection</li> <li>• Possibly gas warning system</li> </ul>

Shelf store



(Photo source: formerly BREVO AG, Horgen)

Block store



(Photo source: Office of Water and Waste, Ct. BE)

## 3 Setting Up a Store

### 3.7 Type and Size of Containers

#### Container type

Containers and packagings for hazardous materials must have mechanical, thermal and chemical resistance suitable to withstand the operational stresses. They must ensure safe storage and safe transport of the materials on the company premises.

For transport outside the company premises, on public roads or by rail, only containers and vessels approved and tested in accordance with ADR/RID may be used. The product compatibility (chemical resistance) must be clarified additionally. Plastic transport containers have a maximum service life. This is 5 years for most of these products.

#### Container size

The volume of the containers for solid, liquid and gaseous materials is between a few millilitres and three cubic metres. The containers are labelled according to transport regulations for hazardous goods as:

Packaging, up to max. 450 litres/container



Large pack (IBC) up to max. 3 m<sup>3</sup>/container



(Photo source: Office of Water and Waste, Ct. BE)

#### Empty containers

Barrels and canisters which contain residual amounts of hazardous materials harbour considerable dangers. For example, explosive air-vapour mixtures are formed with highly inflammable liquids. Contaminated or un-cleaned empty containers must therefore be handled in the same way as full containers. However, they must be stored separately from full containers and must be clearly marked «empty».

Identification (labels) and warning signs must be removed or clearly deleted on empty, properly cleaned containers.

## 3.8 Storage of Special Wastes

Hazardous materials which are no longer used are usually classed as special wastes. These must be handled identically to other hazardous materials until their disposal. They must be assigned to a hazard class, may not be mixed and must be stored accordingly.

At collection points for small quantities of special waste from households and smaller commercial enterprises, their ingredients are often no longer determinable and no safety data sheets are available. It is therefore difficult to assign them to the hazard classes or a storage class. The temporary storage of special wastes at collection points is therefore allowed when certain basic conditions are satisfied (see page 14 below).

## 3 Setting Up a Store

### 3.8 Storage of Special Wastes

#### Minimum requirements for temporary storage of special wastes at collection points

The following requirements only apply for storage of less than a week prior to separate collection of special wastes from households. Longer storage is only allowed in agreement with the responsible authorities.

##### Location and safety

- Place original containers in non-flammable retention pond
- Provide weather protection
- Secure against unauthorised access
- Observe the necessary precautions for handling potentially hazardous materials

#### Requirements for storage of special wastes at collection points

The following requirements must be met for storage of longer than a week prior to separate collection of special wastes from households.

##### Location

- Separate room as a fire section (at least EI 30)
- Frost-protected
- Sealed floor (concrete/asphalt)
- No drain
- Threshold/retention pond (minimum leakage retention in the room)
- Secure against unauthorised access (lock, sign)
- Room marked with «Special waste» and warning signs
- Waste must be easily accessible (light, tidiness)
- Cross-ventilation (bottom-top, to outside)
- Correct electrical installations
- Warning signs

##### Safety

- Store in the original containers, do not refill
- Store the containers in chemical resistant boxes
- Place the containers carefully in the boxes, do not throw or drop
- «No smoking» sign posted
- Wear protective gloves and goggles
- Eye shower and first aid kit on site
- Telephone in the close vicinity, emergency number posted
- Oil-chemical binder and shovel
- Hand-held fire extinguisher, net weight at least 6 kg
- Access to authorised personnel only
- Authorised personnel trained in the handling of hazardous materials
- Store concept

## 4 Identification of Hazardous Materials

### 4.1 Classification Systems

Hazardous materials (as defined by this guideline) can be recognised in different ways. The dangerous properties of materials are evaluated and represented in classification systems. It should be easy to assign these materials to the appropriate storage class (see section 5) based on the information in these systems and in the appropriate databases. In most cases, the label will show you all the necessary data about the dangerous nature of a material at a glance.

The most important and best known classification systems for hazardous materials in Switzerland are

- ➔ classification in accordance with transport regulations (ADR/RID),
- ➔ classification by chemicals law (GHS/CLP).

The Globally Harmonized System (GHS) has superseded the previous European and Swiss system for classification and labelling of chemicals. However, chemical substances that are classified and labelled according to the old regulations may still be stored in industrial and commercial enterprises for years to come.

If you have any questions about earlier labelling, please refer to the 2011 edition of the «Storage of Hazardous Materials» guideline. This can be found on the Internet under <http://www.kvu.ch> → Themen → Stoffe und Produkte.

# 4 Identification of Hazardous Materials

## 4.2 Labelling (Labels)

Hazardous materials containers carry labels in accordance with the Swiss chemical legislation (based on GHS/CLP), the legal transport regulations (ADR/RID), the ordinance on traffic with waste or radiation protection law. A safety data sheet is available. For some materials, the question «Hazardous material: yes or no?» can only be answered by further clarifications. In such cases, we urgently recommend you to consult the experts.

### GHS/CLP pictograms

Every GHS/CLP hazard pictogram must usually have the signal word «DANGER» or «WARNING» added to describe the potential degree of danger. These are accompanied by the hazard notices (H-statements) and the precautionary notices (P-statements).

#### Example: Labelling in accordance with GHS/CLP

Name of the substance or mixture ↓

Hazard pictograms →

Signal word ↑

Name, address Phone number of supplier ↑

Rated quantity when the substance or mixture is to be made accessible to the broad public ↑

Hazard notices H-statements ←

Precautionary notices P-statements ←

	<b>Methanol (solvent)</b> (Index no.: 603-001-00X)	
	Liquid and vapours highly inflammable.	H225
	Toxic if swallowed. Toxic in contact with skin. Toxic if inhaled. Damage to the eyes – risk of blindness.	H301 H311 H331 H370
	Keep away from heat, hot surfaces, sparks, open flame and other types of ignition sources. No smoking. Store in a well-ventilated place. Keep container tightly closed. Wear protective gloves and protective clothing. If on skin. Wash with plenty of soap and water. If swallowed: Call a POISON CENTER/doctor immediately. Store locked up.	P210 P403/233 P280 P302/352 P301/310 P405
<b>Danger</b>	<b>Muster Chemie GmbH</b> Hauptstrasse 10 1111 Musterstadt Phone 032 600 60 60	<b>200 litres</b>

#### Example: Labelling in accordance with ADR/SDR

The UN number and the hazard notice must always be affixed next to each other on the container.

It is also an advantage to list the name in accordance with ADR: In this case Methanol.

That could look like this in practice. ←

#### Example: Labelling in accordance with the ordinance on traffic with waste (VeVA)

The dispensing companies must label packages for the transport of special wastes with the following information:

- With the inscriptions «Sonderabfälle», «déchets spéciaux» and «rifiuti speciali» (Special wastes);
- With the waste code or designation of the wastes according to the waste index;
- With the number of the waste manifest.

That could look like this in practice. ←

<b>Special wastes – Sonderabfälle</b> <b>Déchets spéciaux – Rifiuti speciali</b>		
Waste type <b>Other organic solvents, washing liquids and mother liquors</b>		
Waste manifest no. <b>BB 02374271</b>	Waste code <b>07 01 04</b>	UN no. <b>1230</b>
Date <b>31. 10. 2017</b>	Dispenser <b>Muster Chemie GmbH</b>	

## 4 Identification of Hazardous Materials

### 4.3 Water-Hazardous Materials, Flammable Liquids, Special Wastes

#### Water-hazardous materials

Many liquids are classed as water-hazardous but also materials which become water-hazardous when mixed with water or other liquids. Materials which can already contaminate water in small quantities are classed as highly hazardous to water. The **water-hazardous materials** carry the hazard statements H400, H410, H411, H412, H413 in accordance with GHS/CLP.

The division into water hazard classes is an important source of information with regard to the water hazard.

- This is documented in Switzerland in the «Classification of Water-Hazardous Liquids» list, [www.tankportal.ch](http://www.tankportal.ch) → Informationen as well as [www.kvu.ch](http://www.kvu.ch) → Arbeitsgruppen → Tank Schweiz (only available to enforcement authorities).
- In Germany these are the water hazard classes (WGK), <http://www.umweltbundesamt.de> → Topics → Chemicals → Substances hazardous to water as well as <http://webriigoletto.uba.de/rigoletto>.

#### Flammable liquids

Special fire protection requirements apply for all flammable liquids. They are divided into different hazard classes according to the flash point:

- Liquids up to flash point 23 °C → Flammable liquid 1 and flammable liquid 2.
- Liquids with flash point 23 °C to 60 °C → Flammable liquid 3.
- Liquids with flash point above 60 °C → Flammable liquid without classification.

Heating oil or diesel are classified independently of the flash point in the class «Flammable liquid without classification».

If the ambient temperature exceeds the flash point of a material, its flammable vapours form an explosive atmosphere together with the ambient air. For this reason, further measures must be taken for all materials with a flash point below 30 °C.

#### Special wastes

Special wastes are evaluated and assigned to a storage class based on their constituent materials. They must be stored according to their dangerous properties. If it is prohibited to store special wastes together with other materials, two store sections must be formed within the storage class.



Special wastes

(Photo source: Environment Office, Ct. SO)



Entsorgungshandbuch Schweiz (Swiss Disposal Handbook)

(Photo source: EcoServe International AG, Buchs AG)

#### Disposal Handbook

The current «Entsorgungshandbuch Schweiz» («Swiss Disposal Handbook») (available from EcoServe International AG, 5033 Buchs, [www.eco-serve.ch](http://www.eco-serve.ch), E-mail: [info@ecoserve.ch](mailto:info@ecoserve.ch)) is very helpful for classifying special waste in a storage class. Appropriate hazard classifications in accordance with ADR/RID are assigned to the special wastes in this handbook. One special waste could have several classifications in accordance with ADR/RID. Additional clarification is necessary in this case.

## 5 Storage Classes

### 5.1 Definition

A storage class summarises materials with hazard characteristics that are considered similar and consequently demand similar safety measures. Many materials are classed as potentially water-hazardous. For this reason, spillage and fire fighting water retention must be considered accordingly for all storage classes.

The storage classes (SC) suggested in this guideline were created based on the concept for the storage of hazardous substances in nonstationary containers (TRGS 510). The storage class numbering is derived from international transport law classification (ADR/RID).

Material groups for certain purposes, e.g. paints, fertilisers, pesticides exist in practice. These have different material properties depending on their composition and are therefore assigned to different storage classes. If a material has several dangerous properties, all of these properties need to be considered in the planning of measures. Priority is given to the property which poses the greatest risk. For storage classes with a very high hazard potential – infectious materials (SC 6.2), radioactive materials (SC 7), explosive materials (SC 1) – further measures are necessary and special legal conditions must be observed which are not treated by this guideline.

In the procedural sequence (double page 18/19 and Supplement 1) the flammable liquids (according to TRGS 510 SC 10) and the non-flammable liquids (according to TRGS 510 SC 12) are summarised in the storage class (SC) 10/12. Analogously, storage class 11/13 summarises the flammable solids (according to TRGS 510 SC 11) and the non-flammable solids (according to TRGS 510 SC 13).

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### 5.2 From the Material to the Storage Class

The following rules apply for the assignment of materials to storage classes according to the procedural sequence on the double page 18/19 and Supplement 1:

#### Use of the procedural sequence

Based on the store list, the classification labels according to chemicals and transport law as well as the safety data sheet and any other important material data must be procured and/or kept for the individual hazardous materials. Knowledge of the hazard statements is crucial for the correct use of the procedural sequence.

Based on these data, the procedural sequence must be run through from top to bottom and the hazardous material assigned to a storage class based on its properties and hazard characteristics (e.g. labelling).

The first property (hazard characteristic) of the material found in this sequence leads directly to the appropriate storage class.

Every material is only assigned to one, namely the first, storage class in the procedural sequence which applies to it, even if it has other hazard characteristics.

If a material has none of the properties (hazard characteristics) according to the procedural sequence, it is not usually a hazardous material (non-hazardous material, NH). Further clarifications by a specialist are necessary if in doubt.

# Procedural sequence for identification of hazardous

## Material properties

### Store list

Explosives

Potentially infectious materials

Radioactive materials

Liquefied gases and gases under pressure

Oxidizing materials/organic peroxides

Spontaneously combustible materials

Release of flammable gas in contact with water

Flammable solids

Flammable liquids

Toxic materials

Caustic and corrosive materials

Other liquids

Other solids with hazard labelling

Other solids without hazard labelling

## Characteristics

(labelling, safety)

### ADR/SDR

Labels

Class



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# materials and their storage class assignment

**of hazardous materials**  
(data sheets, material databases)

## Storage classes SC

GHS/CLP			
Labels	Hazard statements		
	H200, H201, H202, H203, H204, H205 H240, H241	→	<b>SC 1</b> Not treated in this guideline
-----	-----	→	<b>SC 6.2</b> Not treated in this guideline
-----	-----	→	<b>SC 7</b> Not treated in this guideline
	H220, H221, H222, H223 H270 H280, H281	→	<b>SC 2</b> Page 23
	H242 H271, H272	→	<b>SC 5</b> Page 28
	H250, H251, H252	→	<b>SC 4.2</b> Page 26
	H260, H261	→	<b>SC 4.3</b> Page 27
	H228	→	<b>SC 4.1</b> Page 25
	H224, H225, H226	→	<b>SC 3</b> Page 24
	H300, H301, H304, H310, H311 H330, H331, H334, H340, H341 H350, H351, H360, H361, H370, H371, H372, H373	→	<b>SC 6.1</b> Page 29
	H290 H314, H318 (if a material is labelled exclusively by H318, this can also be assigned to SC 10/12 or SC 11/13).	→	<b>SC 8</b> Page 30
	H302, H312, H315, H317, H319 H332, H335, H336, H362 H400, H410, H411, H412, H413 incl. all liquids with and without water hazard classification	→	<b>SC 10/12</b> Page 31
	H302, H312, H315, H317, H319 H332, H335, H336, H362 H400, H410, H411, H412, H413 incl. all solids with water hazard classification	→	<b>SC 11/13</b> Page 32
-----	-----	→	<b>Non-hazardous materials (NH) as a rule</b> (e.g. textiles, transport and packaging materials) → clarify

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## 6 Storage Quantities of Hazardous Materials

The stored quantities of hazardous materials determine, inter alia, what requirements a store must meet. Even materials with a low risk potential can present a considerable risk in large quantities. Cooking oil, cooking salt or even a sugar solution in large quantities could be a problem for waters for example.

The following quantity table shows a practical division into different store sizes. The classification in three quantity categories is only a recommendation for store sizes. This classification has no absolute validity especially with regard to safety requirements and must be examined from case to case.

### Quantity table for store organisation

Material quantities (size ranges)	Effect on the storage
<b>Gram/kilogram range</b> (up to approx. 100 kg)	<ul style="list-style-type: none"><li>• Classification-independent in a cabinet or room</li><li>• Observe joint storage instructions</li></ul>
<b>Kilogram/ton range</b> (approx. 100 kg to approx. 1,000 kg)	<ul style="list-style-type: none"><li>• Classification-dependent in separate cabinets or fire sections</li><li>• Observe joint storage instructions</li><li>• Spillage and fire fighting water retention</li><li>• Possibly summary report according to the Major Accidents Ordinance*</li></ul>
<b>From ton range</b> (more than approx. 1,000 kg)	<ul style="list-style-type: none"><li>• Classification-dependent in separate fire sections</li><li>• Limitation of the storage quantities per fire section</li><li>• Observe joint storage instructions</li><li>• Spillage and fire fighting water retention</li><li>• Possibly summary report according to the Major Accidents Ordinance*</li></ul>

\* If the existing quantities of material in the company exceed the threshold quantities stipulated in the Major Accidents Ordinance (MAO), a summary report must be compiled in accordance with MAO. Information is available from the responsible office.

## 7 Joint Storage of Hazardous Materials

Supplement 2 (General joint storage of hazardous materials) shows which hazardous material groups (storage classes) can be stored together without problems and which cannot. Supplement 2 also shows whether and under what conditions frequently used basic chemicals (acids, alkalis and watery solutions) may be stored together.

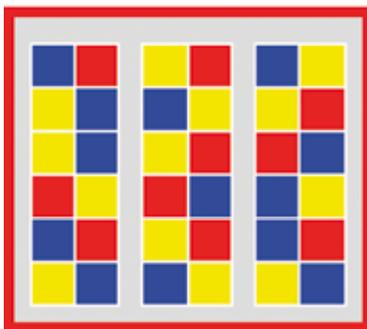
The following basic principles apply for evaluation of the joint storage:

- ➔ Hazardous materials must be stored separately depending on their properties (hazard label, safety data sheet). Disorderly storage of hazardous materials of different hazard classes is not permissible.
- ➔ The storage of flammable empty packaging materials (wood, cardboard, paper, plastic, etc.) is not permissible in store rooms with hazardous materials.

## 7 Joint Storage of Hazardous Materials

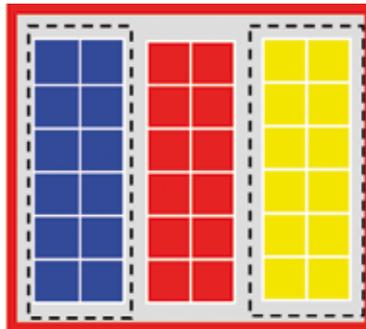
- Hazardous materials of different storage classes may only be stored together when the concepts for action are based on the most hazardous material properties and are suitable for all materials. The basic conditions (storage quantities, fire section size) defined for the most dangerous product in accordance with the VKF (Association of Fire Insurance) fire protection regulation «Hazardous Materials», 26–15de, may not be exceeded on the whole. It must be noted that the VKF (Association of Fire Insurance) fire protection regulation refers, in this context, to material segregation and not to joint storage.
- Materials of the same storage class can also react dangerously with each other. In such cases, the materials must be stored separately in separate fire sections or compliant with specific protection conditions (distances, shielding walls, separate retention ponds) in the same fire section. The evaluation must be made by a specialist.
- The hazard notices (hazard statements) and the labels on the packagings and containers as well as the **information in the safety data sheets** must be observed to determine whether joint storage is allowed.

The storage forms described below are possible depending on the storage classes:



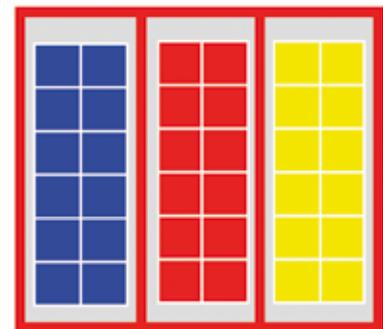
### Joint storage

Storage of different goods in the **same fire section**, without special segregation.



### Segregated storage

Storage of different goods in the **same fire section**, compliant with **special requirements and protection conditions** such as distances (at least 2.5 m), shielding walls or separate retention ponds.



### Separate storage

Storage of different goods in clearly **separated fire sections**.



Segregated storage (shielding wall and separate retention ponds) in the same fire section

(Photo source: Environment Office, Ct. SO)

## 8 Store Requirements for the Storage Classes

The requirements listed in the following table apply regardless of the storage class for all hazardous material stores. If there are any contradictions between the general requirements and the storage class-specific requirements (section 8.1 and following sections), those of the specific storage class have priority.

### General safety requirements for all storage classes (SC)

The detailed storage requirements for the individual storage classes are described in sections 8.1. to 8.10.

Quantity per fire section	up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg
<b>Joint storage</b>	No special restrictions, but observe the joint storage instructions!	Segregated storage necessary (in the same fire section with special requirements)	Separate storage necessary (separate fire section)
<b>Identification of hazardous materials</b>	Clear labelling of the containers		
<b>Safety data sheet</b>	Current safety data sheets available in the company and accessible at all times		
<b>General safety requirements</b>	<ul style="list-style-type: none"> <li>• Sufficient space available for safe handling (e.g. collision and ram protection)</li> <li>• Adequate lighting available</li> <li>• Floor for stored goods sealed and made of non-flammable material</li> <li>• No storage of hazardous materials in stairways, generally accessible corridors and along traffic routes within the company</li> <li>• Furnishings in the store made only from non-flammable materials</li> <li>• Identification of the fire sections according to their storage class</li> <li>• Segregated storage of hazardous materials and other materials</li> <li>• A container defect can be detected easily and repaired immediately</li> <li>• Instruction of personnel with regard to fire protection, work safety and smoking ban</li> </ul>		
<b>Fire protection General</b>	Storage quantity limitations according to VKF (Association of Fire Insurance) fire protection regulation "Hazardous Materials"		Storage quantity and fire section restrictions as well as technical fire protection equipment in accordance with the VKF (Association of Fire Insurance) regulation «Hazardous Materials»
<b>Fire protection in the building</b>	Non-flammable or flame-retardant cabinet	at least EI 30 room or EI 30 cabinet	at least EI 60 room
<b>Outdoor fire protection</b>	No protective distances necessary	Protective distances necessary depending on the neighbourhood (VKF (Association of Fire Insurance) fire protection regulations), distances can be shortened by shielding walls	
<b>Water protection</b>	<ul style="list-style-type: none"> <li>• Suitable measures (e.g. retention ponds) which can contain any spillages in the event of an accident must be taken for the storage of hazardous materials (solid or liquid) as well as materials which can cause a dangerous chemical reaction in contact with water.</li> <li>• Contamination of waters (ground and surface water), the public sewer system and the ground/subsoil must be generally prevented.</li> <li>• The storage of water-hazardous liquids is not permitted in regions of the ground water protection zones S1 and S2!</li> </ul>		
<b>Fire fighting water retention</b>	Fire fighting water retention according to the guideline for practice «Fire Fighting Water Retention».		
	For highly toxic materials	For materials that are highly hazardous to water (class A)	Also for the other water-hazardous materials in large quantities
<b>Environmental protection</b>	Containers are tightly sealed		
<b>Work safety</b>	<ul style="list-style-type: none"> <li>• Post specific hazard notices and warning signs (see page 41, Warning Signs)</li> <li>• Personal protective equipment (PPE) is available for emergencies</li> </ul>		
<b>Chemical safety</b>	<ul style="list-style-type: none"> <li>• Chemical safety officer is appointed and has been reported to the authorities if necessary</li> <li>• Containers must be protected against dangerous influences, especially of a mechanical nature</li> <li>• Containers are mechanically, thermally and chemically resistant</li> <li>• Hazardous materials are stored inaccessibly for unauthorised persons</li> <li>• Hazardous materials are stored separately from foodstuffs, fodder and medicines</li> <li>• Materials which can react dangerously with each other are stored separately</li> <li>• Containers are identified and labelled according to legal specifications</li> </ul>		
<b>Accident prevention</b>	A summary report is compiled in accordance with the Major Accident Ordinance if a threshold quantity is exceeded		
		An up-to-date, readily available store list is on hand It may be necessary to draw up a fire service emergency plan	
<b>ADR/SDR and RID</b>	Hazardous goods safety officers are appointed and reported to the responsible authorities if necessary		

## 8 Store Requirements for the Storage Classes

### 8.1 Liquefied Gases or Gases under Pressure/Storage Class 2



#### Danger

Containers can become projectiles if they are destroyed by fire or accident. Gas bottles can fly several hundred metres and destroy buildings or parts of buildings. Flying pressurized gas containers are a problem, above all, for employees and rescue services. High concentrations of gases can form quickly in case of leakages. They can be toxic, suffocating or explosive. Special regulations must be observed especially for the storage of **propane gas**, **ammonia** and **chlorine gas**. Contact the responsible office if you have any questions regarding the storage of these gases.

#### Store rooms

- The store must be chosen so that safe incoming and outgoing delivery of the gas bottles is ensured.
- Free-standing buildings without cellars or wire-mesh paddocks are most suitable as stores. The stores should be arranged on an outside wall of the ground floor of the building. The protective caps must be fitted and the gas bottles protected from falling over in the store.
- Pressurised gas containers (spray cans, aerosol cans) must be stored behind a wire mesh which enables gases to escape and retains flying containers.
- Adequate ventilation must be ensured for all gases. Where natural ventilation is not possible (e.g. cellars), artificial ventilation must be installed. Storage in an outdoor, wire-mesh paddock is an advantage because there is no need for extra ventilation in this case.
- Gas bottles may not be stored in the vicinity of flammable materials.



(Photo source: Carbagas AG, Gümligen BE)

#### Special safety requirements for SC 2

Quantity per fire section	up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg
<b>Gen. remarks</b>	<ul style="list-style-type: none"> <li>• Gases can have a suffocating, oxidizing, explosive, toxic and corrosive effect</li> <li>• A reserve bottle near to connected bottles is not classed as a store</li> <li>• Special store concepts must be created for toxic gases</li> </ul>		
<b>Joint storage General</b>	Joint storage with SC 11/13 and non-hazardous materials (NH) possible under compliance with special requirements	Separate storage (separate fire section)	
<b>Joint storage within SC 2</b>	No restriction	Storage of gases with different properties in the same fire section under compliance with special requirements (segregated storage) possible	
<b>Joint storage Aerosol cans</b>	Storage with SC 11/13 and non-hazardous materials (NH) in the same fire section possible under compliance with special requirements (segregated storage)		
<b>General fire protection</b>	<ul style="list-style-type: none"> <li>• If gas is flammable and heavier than air, then Ex-Zone 2, up to 1 m from the floor</li> <li>• If gas is flammable and equally heavy or lighter than air, then Ex-Zone 2, whole room</li> <li>• A suitable lightning protection system must be installed with determination of the Ex-Zone</li> <li>• Special requirements must be observed for composite bottles (EI 60)</li> </ul>		
<b>Fire protection in the building</b>	Natural or artificial lighting (3 to 5-fold), extraction top and bottom depending on the gas		
<b>Work safety</b>	<ul style="list-style-type: none"> <li>• Gas bottles must be secured against falling over</li> <li>• Post warning sign «Gas bottles»</li> <li>• Post the additional hazard notice in the form of the «Ex warning sign» if flammable</li> <li>• For liquefied gases: No floor drains, light shafts or similar within 5 m distance to possible gas escape points</li> </ul>		
<b>ADR/SDR and RID</b>	For gases with the ADR classification codes T, TF, TC, TO, TFC, TOC, a risk assessment with a security plan is necessary (exception pressurised gas containers)		

# 8 Store Requirements for the Storage Classes

## 8.2 Flammable Liquids/Storage Class 3



### Danger

In case of fire, these materials burn very quickly to explosively. They accelerate the spreading of fire by spillage. Since they are generally lighter than water and often do not mix with water, they swim on the fire fighting water and continue burning. Many of these materials are hazardous to health and water. Vapours from flammable liquids are generally explosive. The spark of a light switch or an electrostatic discharge can ignite these vapours. Empty containers which have not been cleaned often contain explosive air-vapour mixtures.

### Store rooms

- Flammable liquids must be stored in separate fire sections. Escaping liquids must be containable in retention ponds or in the room (threshold without drain). At a flash point of < 30 °C (highly inflammable liquids in accordance with Suva), Ex measures must be taken for protection against explosions. These especially include ventilation measures and suitable electrical installations and equipment (see Explanations, section 11).
- Most flammable liquids also pose a hazard for the ground, subsoil and water. Therefore, the commercially available safety equipment must be used for their storage.



(Photo source: Zurich Building Insurance Association, GVZ)

### Special safety requirements for SC 3

Quantity per fire section	up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg
<b>Joint storage</b>	No special restrictions, but observe the joint storage instructions!	Separate storage especially also of non-hazardous materials Storage with SC 10/12 in the same fire section possible under compliance with special requirements (segregated storage)	Separate storage (separate fire section)
<b>General fire protection</b>	Reasonable Ex protection	Ex-Zone 2, up to 1 m from the floor Earthing or potential equalisation from 450 litres	Ex-Zone 2, up to store height at least 1 m from the floor (value from experience) Earthing or potential equalisation up to 2,000 litres Lightning protection system from 2,000 litres
<b>Fire protection in the building</b>	Non-flammable cabinet RF 1 Adequate ventilation	Less than 450 litres of flammable liquids (H224, H225, H226) in EI 30 room with low fire risk or in EI 30 cabinet  Natural or artificial lighting (3 to 5-fold), extraction at bottom	More than 450 litres of flammable liquids (H224, H225, H226) in EI 60 room, more than 2,000 litres in EI 90 room, Quantity may have to be limited
<b>Outdoor fire protection</b>		Protection distances depending on the neighbourhood (VKF Association of Fire Insurance, fire protection regulation «Hazardous Materials»)	
<b>Water protection</b>	Retention pond must be chemically resistant and have at least the usable volume of the largest container	Total storage area/room forms a drainless pond, roofing must be provided for outdoor storage	
<b>Fire fighting water retention</b>	See the table on page 22 for fire fighting water retention		
<b>Compulsory permission/registration (cantonal authorities)</b>	Not subject to compulsory permission/registration up to 450 litres total volume	More than 450 litres total volume <u>within</u> the ground water protection zone S3 and ground water protection areas <u>subject to compulsory permission</u>  More than 450 litres total volume <u>outside</u> the ground water protection zone S3 and ground water protection areas <u>subject to compulsory registration</u>	Containers bigger than 2,000 litres with <u>water-hazardous liquids of class A</u> , in water protection areas A <sub>1</sub> /A <sub>2</sub> and areas of contribution Z <sub>1</sub> /Z <sub>2</sub> <u>subject to compulsory permission</u> , otherwise compulsory registration
<b>Work safety</b>	Post warning sign «Flammable materials»	Post warning signs «Flammable materials» and «EX» (explosive atmosphere)	
<b>ADR/SDR and RID</b>	For materials with the ADR classification code D, a risk assessment with a security plan is necessary		

## 8 Store Requirements for the Storage Classes

### 8.3 Flammable Solids/Storage Class 4.1



#### Danger

Solids behave differently to liquids in a fire. This can range from smouldering to a very fierce burning. The following points must be observed in particular:

- Dusts of flammable solids can be explosive even if they are not hazardous materials.
- Solids can smoulder undetected for long periods of time (days to weeks) which can lead to self-heating and sudden breakout of fires.
- Many of these materials are hazardous to health and water.

#### Store rooms

- Tricking out of powders onto the floor or onto other containers must be prevented.
- Freedom from dust in the room or clearing of any dust deposits are to be given top priority.



(Photo source: Environment Office, Ct. TG)

#### Special safety requirements for SC 4.1

Quantity per fire section	up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg
<b>Joint storage</b>	No special restrictions, but observe the joint storage instructions!	Separate storage especially also of non-hazardous materials Storage with SC 10/12 and 11/13 in the same fire section possible under compliance with special requirements (segregated storage)	Separate storage (separate fire section)
<b>General fire protection</b>	Dust deposits must always be removed immediately		
<b>Water protection</b> <b>Fire fighting water retention</b> If mixing with water possible (sprinklers, fire fighting water)	See the table on page 22 for fire fighting water retention		
<b>Work safety</b>	Post warning sign «Flammable materials»		
<b>ADR/SDR and RID</b>	For materials with the ADR classification codes D and DT, a risk assessment with a security plan is necessary For materials with the ADR classification code SR2, permanent temperature monitoring is necessary for transport, and is also recommended for storage.		

## 8 Store Requirements for the Storage Classes

### 8.4 Spontaneously Combustible Materials/Storage Class 4.2



#### Danger

Spontaneously combustible materials even in small quantities including mixtures and solutions (solid or liquid) can ignite quickly in contact with air.

Examples: Phosphorous (white or yellow), freshly produced metal powder.

By contrast, materials and objects, including mixtures and solutions, that are capable of self-heating can only ignite in contact with air and without energy input in larger quantities (several kilograms) and after longer periods of time (hours or days).

Examples: Fishmeal (not stabilised), waste in a form capable of self-heating

#### Store rooms

- Exposure of these materials to higher temperatures, e.g. sunlight, must be avoided. Problematical temperature increases due to internal friction must be ruled out if possible during storage and handling.
- Outdoor storage is not recommended because it is difficult to keep the storage temperature constant.
- Spontaneously combustible materials may only be stored in the vicinity of work places in quantities which are absolutely essential for continuation of the work.
- Spontaneously combustible materials must be stored separately from other explosive, oxidizing and flammable materials as well as being protected against spreading of fires.



(Photo source: Main-Taurus-Gymnasium, Hofheim, Germany)

#### Special safety requirements for SC 4.2

Quantity per fire section	up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg
<b>Joint storage</b>	No special restrictions, but observe the joint storage instructions!	Separate storage (separate fire section)	
<b>General fire protection</b>	<ul style="list-style-type: none"> <li>• Storage in original containers only</li> <li>• Regular temperature check</li> </ul>		
<b>Water protection</b>	Retention pond must be chemically resistant and have at least the usable volume of the largest container		
<b>Fire fighting water retention</b>	See the table on page 22 for fire fighting water retention		
<b>Compulsory permission/registration (cantonal authorities) Only for liquids</b>	Not subject to compulsory permission/registration up to 450 litres total volume	More than 450 litres total volume <u>within</u> the ground water protection zone S3 and ground water protection areas <u>subject to compulsory permission</u>	
		More than 450 litres total volume <u>outside</u> the ground water protection zone S3 and ground water protection areas <u>subject to compulsory registration</u>	Containers bigger than 2,000 litres <u>with water-hazardous liquids of class A</u> , in water protection areas A <sub>1</sub> /A <sub>2</sub> and areas of contribution Z <sub>1</sub> /Z <sub>2</sub> , <u>subject to compulsory permission</u> , otherwise compulsory registration
<b>Work safety</b>	Post hazard notice «Spontaneously combustible materials»		

## 8 Store Requirements for the Storage Classes

### 8.5 Materials that Release Flammable Gases in contact with Water/Storage Class 4.3



#### Danger

Materials of this class react with water to release flammable or explosive gases. Such a reaction generally releases so much heat that the gas spontaneously ignites.

Examples: Calcium, zinc powder, zinc dust, calcium carbide, aluminium carbide, sodium batteries or cells, by-products of aluminium production.

#### Store rooms

- These materials must be stored separately from other hazardous materials and not outdoors if possible.
- Cross-ventilation of the store room is recommended. The materials must be stored in a dry, cool place in tightly sealed containers.
- Joint storage with halogens (fluoride, chlorine, bromide), acids, water and oxidants (peroxides) presents a special risk.



(Photo source: Sodium in water, Thomas Seilnacht, Germany  
www.seilnacht.com)

#### Special safety requirements for SC 4.3

Quantity per fire section	up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg
<b>Joint storage</b>	No special restrictions, but observe the joint storage instructions!	Separate storage (separate fire section)	
<b>General fire protection</b>	<ul style="list-style-type: none"> <li>• Storage in original containers only</li> <li>• Suitable fire extinguisher (not water-based)</li> </ul>		
<b>Water protection</b>	Retention pond must be chemically resistant and have at least the usable volume of the largest container		
<b>Fire fighting water retention</b>	See the table on page 22 for fire fighting water retention		
<b>Compulsory permission/registration (cantonal authorities) Only for liquids</b>	Not subject to compulsory permission/registration up to 450 litres total volume	More than 450 litres total volume <u>within</u> the ground water protection zone S3 and ground water protection areas <u>subject to compulsory permission</u>	Containers bigger than 2,000 litres with <u>water-hazardous liquids of class A<sub>1</sub></u> , in water protection areas A <sub>1</sub> /A <sub>2</sub> and areas of contribution Z <sub>1</sub> /Z <sub>2</sub> <u>subject to compulsory permission</u> , otherwise compulsory registration
<b>Work safety</b>	Post hazard notice «Releases flammable gases in contact with water» and «Do not extinguish with water» Protect from wet		

# 8 Store Requirements for the Storage Classes

## 8.6 Oxidizing Materials/Storage Class 5



### Danger

These materials form flammable or explosive mixtures together with flammable materials. A flammable material need not always necessarily be classified as a hazardous material. A material which is generally flammable, e.g. sugar, paper or wood shavings suffices. Organic peroxides **deserve special mention**. These have the properties of oxidizing and flammable materials. They generally burn very fiercely to explosively. Organic peroxides which have explosive properties according to classification and labelling (hazard statements: H240, H241) must be handled specially by the store concept.

### Store rooms

- These materials must be stored separately from flammable and corrosive materials even if the flammable materials are not actually hazardous materials (wood, paper, etc.).
- Refrigerated storage of the containers may also be necessary for storing **organic peroxides** depending on the material properties.
- Flammable (oxidizing) materials and organic peroxides must be stored separately. The room may be arranged (with a separate cabinet for the peroxides) as shown in the photo below.



(Photo source: Ammonium dichromate Jan Hartmann, www.illumina-che-



(Photo source: Environment Office, Ct. SO)

### Special safety requirements for SC 5

Quantity per fire section	up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg
<b>Joint storage</b>	No special restrictions, but observe the joint storage instructions!	Separate storage (separate fire section) Do not store strong oxidants (H271) on wooden pallets	
<b>General fire protection</b>	<ul style="list-style-type: none"> <li>• Storage in original containers only</li> <li>• Regular temperature check for organic peroxides</li> </ul>		
<b>Fire protection in the building</b>	2.5 m away from flammable materials	Separate storage in EI 60-RF1 room or EI 60-RF1 cabinet	
<b>Water protection</b>	Retention pond must be chemically resistant and have at least the usable volume of the largest container		
	Total storage area/room forms a drainless pond, roofing must be provided for outdoor storage		
<b>Fire fighting water retention</b>	See the table on page 22 for fire fighting water retention		
<b>Compulsory permission/registration (cantonal authorities) Only for liquids</b>	Not subject to compulsory permission/registration up to 450 litres total volume	More than 450 litres total volume <u>within</u> the ground water protection zone S3 and ground water protection areas <u>subject to compulsory permission</u>	Containers bigger than 2,000 litres <u>with</u> water-hazardous liquids of class A <sub>1</sub> in water protection areas A <sub>1</sub> /A <sub>2</sub> and areas of contribution Z <sub>1</sub> /Z <sub>2</sub> <u>subject to compulsory permission</u> , otherwise compulsory registration
<b>Work safety</b>	Post warning sign «Oxidizing materials»		
<b>ADR/SDR and RID</b>	For organic peroxides with the ADR classification code P2, a permanent temperature check during transport is necessary and is also recommended for storage		

## 8 Store Requirements for the Storage Classes

### 8.7 Toxic Materials/Storage Class 6.1



#### Danger

These materials, even in very small quantities (a few milligrams to one gram), can have a very serious health-damaging effect or even fatal consequences for man and animals. These materials are absorbed by the digestive system, the respiratory tracts or the skin.

#### Store rooms

The following must be observed for the storage of toxic materials:

- They must be stored separately from foodstuffs, fodder and medicines
- They must be stored inaccessibly for unauthorised persons.
- One's own personal protection and the protection of others is always top priority when handling toxic materials.
- Staff must be trained periodically with regard to the handling, hazards, safety and emergency measures.



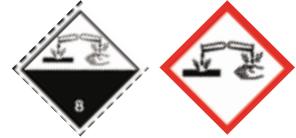
(Photo source: Growag Feuerwehrtechnik AG Grosswangen)

#### Special safety requirements for SC 6.1

Quantity per fire section	up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg
<b>Joint storage</b>	No special restrictions, but observe the joint storage instructions!	Separate storage especially also of non-hazardous materials. Storage with SC 8, 10/12 and 11/13 in the same fire section possible under compliance with special requirements (segregated storage)	Separate storage (separate fire section)
<b>Water protection</b>	Retention pond must be chemically resistant and have at least the usable volume of the largest container		
<b>Fire fighting water retention</b>	Total storage area/room forms a drainless pond, roofing must be provided for outdoor storage		
<b>Compulsory permission/registration (cantonal authorities) Only for liquids</b>	See the table on page 22 for fire fighting water retention	Not subject to compulsory permission/registration up to 450 litres total volume	More than 450 litres total volume <u>within</u> the ground water protection zone S3 and ground water protection areas <u>subject to compulsory permission.</u>
<b>Chemical safety</b>	Store separately from foodstuffs, fodder and medicines	More than 450 litres total volume <u>outside</u> the ground water protection zone S3 and ground water protection areas <u>subject to compulsory registration.</u>	Containers bigger than 2,000 litres with <u>water-hazardous liquids of class A<sub>v</sub></u> in water protection areas A <sub>v</sub> /A <sub>v</sub> and areas of contribution Z <sub>v</sub> /Z <sub>v</sub> <u>subject to compulsory permission</u> , otherwise compulsory registration
<b>Work safety</b>	• Post warning sign «Toxic materials» • If the materials can develop toxic vapours: Adequate ventilation, see the information on the safety data sheet		
<b>ADR/SDR and RID</b>	For materials of packaging group I, a risk assessment with a security plan is necessary		

# 8 Store Requirements for the Storage Classes

## 8.8 Caustic and Corrosive Materials/Storage Class 8



### Danger

It should be noted that these materials

- can cause serious damage to health or even death in contact with the skin, the eyes or if swallowed;
- can attack and decompose metals.

### Store rooms

- These materials must be separated from the following materials: Materials which release toxic gases with acids, oxidizing materials, foodstuffs, fodder and medicines.
- Retention ponds or outer barrels must be made of medium-resistant material (special plastics).
- Acids or alkalis react with each other sometimes to produce extreme heat. They must therefore be stored separately from each other. This can be in the same fire section if mixing of the materials can be avoided (separate retention ponds) in the event of a fire or spillage.

See supplement 2

«General joint storage of hazardous materials».



(Photo source: Environment Office, Ct. SO)

### Special safety requirements for SC 8

Quantity per fire section	up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg
<b>Joint storage</b>	No special restrictions, but observe the joint storage instructions!	Separate storage especially also of non-hazardous materials. Storage with SC 6.1, 8 (conditional), 10/12 and 11/13 in the same fire section possible under compliance with special requirements (segregated storage)	Separate storage (separate fire section)
<b>Water protection</b>	Retention pond must be chemically resistant and have at least the usable volume of the largest container		
	Total storage area/room forms a drainless pond, roofing must be provided for outdoor storage		
<b>Fire fighting water retention</b>	See the table on page 22 for fire fighting water retention		
<b>Compulsory permission/registration (cantonal authorities) Only for liquids</b>	Not subject to compulsory permission/registration up to 450 litres total volume	More than 450 litres total volume <u>within</u> the ground water protection zone S3 and ground water protection areas <u>subject to compulsory permission</u>	Containers bigger than 2,000 litres with <u>water-hazardous liquids of class A</u> , in water protection areas A <sub>0</sub> /A <sub>1</sub> and areas of contribution Z <sub>0</sub> /Z <sub>1</sub> , <u>subject to compulsory permission</u> , otherwise compulsory registration
<b>Chemical safety</b>	Store separately from foodstuffs, fodder and medicines		
<b>Work safety</b>	Post warning sign «Corrosive materials»		Adequate natural or artificial ventilation

# 8 Store Requirements for the Storage Classes

## 8.9 Liquid Materials/Storage Class 10/12



### Danger

Health-hazardous or irritant materials can lead to damage to health in case of contact or swallowing. In addition, the environmentally hazardous materials which have no other hazardous properties are included in this class. Since all the materials in this group are liquids, seepage of these materials into the ground and subsoil or surface water or ground water can be expected in case of spillages and accidents.

### Store rooms

- When storing these materials, special care must be taken to ensure that they cannot infiltrate the ground, surface water or ground water. The stores must be equipped with retention measures (retention ponds, etc.).
- Transshipment and handling must not be carried out on unsealed terrain and it must be ensured that no materials can get into the sewer system or the ground (cover over drain shafts, gates in the sewer system or retention ponds).
- The **halogenated hydrocarbons form a special group**. Most building materials, especially concrete, are permeable for this materials group (perchloroethylene, chloroform, methylene-chloride). For this reason, this materials group must be stored in steel retention ponds with 100 % retention volume.



(Photo source: Growag Feuerwehrtechnik AG, Grosswangen)

### Special safety requirements for SC 10/12

Quantity per fire section	up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg
<b>Joint storage</b>	No special restrictions, but observe the joint storage instructions!	SC 4.2, 4.3 and 5 must be stored separately from SC 10/12. Joint storage with other storage classes possible under compliance with special requirements (segregated storage)	Separate storage (separate fire section)
<b>Fire protection in the building</b>	From 25 litres of flammable liquids with a flash point of > 60 °C in a cabinet RF1	For more than 450 litres of flammable liquids with a flash point of > 60 °C in an EI 30 room	For more than 2,000 litres of flammable liquids with a flash point of > 60 °C in an EI 60 room
<b>Water protection</b>	Retention pond must be chemically resistant and have at least the usable volume of the largest container		
	Total storage area/room forms a drainless pond, roofing must be provided for outdoor storage		
<b>Fire fighting water retention</b>	See the table on page 22 for fire fighting water retention		
<b>Compulsory permission/registration (cantonal authorities)</b>	Not subject to compulsory permission/registration up to 450 litres total volume	More than 450 litres total volume <u>within</u> the ground water protection zone S3 and ground water protection areas <u>subject to compulsory permission</u>	Containers bigger than 2,000 litres with <u>water-hazardous liquids of class A<sub>1</sub></u> , in water protection areas A <sub>1</sub> /A <sub>2</sub> and areas of contribution Z <sub>1</sub> /Z <sub>2</sub> <u>subject to compulsory permission</u> , otherwise compulsory registration
		More than 450 litres total volume <u>outside</u> the ground water protection zone S3 and ground water protection areas <u>subject to compulsory registration</u>	

## 8 Store Requirements for the Storage Classes

### 8.10 Solid Materials/Storage Class 11/13



#### Danger

Health-hazardous or irritant materials can lead to damage to health in case of contact or swallowing. In addition, the environmentally hazardous materials which have no other hazardous properties are included in this class. Unlike storage class 10/12, these materials are solid. Spillages and accidents here only lead to an environment problem if these materials are washed away with fire fighting water or rain water or carried away by the wind.

#### Store rooms

- These materials must be stored in a clean and dry place. The stores must be equipped with retention ponds. Transshipment and handling may only be carried out on sealed terrain.
- It must be ensured that no materials can get into the sewer system or ground/subsoil (cover over drain shafts, gates in the sewer system or retention pond) in case of accidental release.
- **Storage of lithium batteries:** Depending on the quantity and performance class of the lithium batteries, they must be stored separately in limited quantities in separate fire-proof areas or by respecting a safety distance and an automatic extinguishing system, etc. must be provided if necessary. Consult the fire safety office.

[www.vds.de](http://www.vds.de) Publication of the German Damages Insurance Fund, Lithium Batteries, VdS 3103:2016-05 (02).



(Photo source: Environment Office, Ct. TG)

#### Special safety requirements for SC 11/13

Quantity per fire section	up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg
<b>Joint storage</b>	No special restrictions, but observe the joint storage instructions!	SC 3, 4.2, 4.3 and 5 must be stored separately from SC 11/13 Joint storage with SC 2, 4.1, 6 8, 10/12 and non-hazardous materials possible under compliance with special requirements (segregated storage)	Separate storage (separate fire section)
<b>General fire protection</b>	Remove dust deposits regularly		
<b>Water protection</b> <b>Fire fighting water retention</b> Possible if mixing with water (sprinklers, fire fighting water)	See the table on page 22 for fire fighting water retention		

## 9 Organisation and Operation of the Store

### 9.1 Organisational Measures

Companies that store or transport hazardous materials must take appropriate safety measures. The requirements for storage and transport are not identical but they do cover the same issues basically.

- **The personnel** must be instructed as to how to behave in emergencies (accident, fire, leakages, etc.) .
- The protective equipment in stores with hazardous materials must be inspected at regular intervals.
- If a chemicals store is operated, a **Chemicals Safety Officer** according to chemical law and, if necessary, a **Hazardous Goods Safety Officer (GGB)** according to the hazardous goods safety officer ordinance must be appointed. Hazardous Goods Safety Officers must complete the appropriate training and must always be reported to the authorities.
- Safety data sheets must be available for all hazardous materials available in the **company**; these must be kept up to date and made accessible to the personnel. It is also recommended to keep other documentation in the form of instructions for use, accident information sheets etc.
- A **store list** must be compiled which records the type, quantities and storage location of the hazardous materials to give you an overview of the hazard potential in the event of an incident (e.g. leakage) or fire.  
The fire brigade must be informed about the store list and its whereabouts in the company.  
Content of the store list
  - Maximum material quantity per storage class (SC).
  - Store sections in which the different storage classes are located.
  - Latest records of the material quantities per storage class if possible.
- It is necessary to implement **access control**, to ensure that only personnel who are appropriately trained and instructed and are aware of the necessary protection and emergency measures have access to the chemicals store.
- The following information is extremely important for exercising an **alarm and emergency organisation: List of phone numbers** of hospital, doctor, poison centre, company staff responsible and cantonal emergency services (e.g. fire brigade and police).
- The appropriate **personal protective equipment (PPE)** must be available for the clearance of minor leakages. See the safety data sheets for the required PPE.
- At least one **eye shower** is required, a whole-body emergency shower must be installed if necessary.
- With regard to the specific requirements for work safety, the **FCOS and Suva regulations** and their branch-specific implementation are referred to.
- The necessity for **emergency planning** must be discussed with the enforcement authorities of the accident prevention and fire and chemical protection services. It is recommended to hold fire drills on the company premises to familiarise the services with the locality and hazards.

#### Theft

The more dangerous and special the properties of the stored materials are, the greater the risk of illegal appropriation (theft) is. Suitable precautionary measures must be taken.

#### Training/special knowledge

Once a store has been built and is in operation, the personnel have the biggest influence on maintaining security. Personnel training therefore plays a decisive and central role.

## 9 Organisation and Operation of the Store

### 9.1 Organisational Measures

#### Traffic routes in stores

Traffic routes in stores should have a minimum width of 0.8 m (better 1.2 m) for human traffic and, for forklift truck traffic, the width of the truck plus 0.5 m on either side of the truck.

Store furnishings which could cause a hazard if physically damaged must be adequately protected, by equipment for collision and ramming protection among other things.



(Photo source: Kaiser+Kraft AG, Cham)

#### Maintenance and service work

Safety precautions which apply for normal operation can be circumvented for maintenance and service work when ignition sources (e.g. during welding, milling, cutting, etc.) are used. Careful planning of this work is therefore absolutely essential.

#### Warnings

Warnings of the specific hazards must therefore be posted prominently by pictograms or similar in suitable positions in the store. No smoking signs, in particular, must be posted at the respective entrances.

#### Handling of hazardous materials and personal protection measures

Hazardous materials are not normally handled or worked with directly in a store. However, situations can arise, e.g. incidents with leakages, clearing work or withdrawal of samples, in which one can come into direct contact with the materials. For these reasons, personal protection is important at all times. Personal protective equipment (protective clothing, protective goggles, chemical-resistant gloves, boots, etc.) appropriate to the respective hazard must therefore be worn. Additional respiratory equipment might be necessary under some circumstances.

The probability of accidents can be reduced considerably by working tidily and avoiding pressure of time. Stress increases the safety risk!

Regular washing of the hands after handling hazardous materials, showering and a change of clothes, if necessary, as well as preventive skin protection round off the personal measures.

It must be ensured that the employees have the necessary personal protective equipment at their disposal at all times and use this correctly.

### 9.2 Goods Delivery, Shipment and Transshipment Point

In the area of goods delivery and shipment, material separation as it applies for the store is often difficult or impossible to implement. For this reason, situation-related, appropriate and stricter demands must be made in these areas:

- Separate fire section for such areas
- Defined intermediate storage areas and free lanes
- Keep free overnight and at weekends if possible
- Connection of these areas to retention ponds and fire fighting water retention ponds
- Company access control also applies for drivers
- Extra training of personnel with regard to these special problems
- Safety measures must be adapted to all possible hazards and combinations thereof. Especially for **transshipment of water-hazardous materials**, a resistant, sealed floor is necessary for the stored goods.

It must also be ensured that there is no floor drain into the sewer system in the immediate vicinity. If floor drains are available, additional measures must be taken (e.g. gate, lockable lid).

# 10 Regulations

## 10.1 Most Important Laws and Directives

### Legal consequences

Persons who refrain from implementing the legal regulations accordingly can expect to be prosecuted and to have to bear the costs in the event of resulting incidents. Curtailment of insurance benefits can be expected additionally.

Regulations	CC No. <sup>1</sup>	Validity
<b>Federal laws/International law</b>		
<a href="http://www.admin.ch/gov/en/start.html">www.admin.ch/gov/en/start.html</a> → Federal law → Classified compilation		
• Environmental Protection Act (EPA)	814.01	• Protection of the environment, damage liability
• Waters Protection Act (WPA)	814.20	• Protection of surface and underground water against negative effects • Storage of water-hazardous materials
• Chemicals Act (ChemA)	813.1	• Protection of life and health against damaging effects of materials and preparations
• Labour Act (ArG) • Accident Insurance Act (UVG)	822.11 832.20	• Protection of employees against accidents and damage to health due to hazardous materials
• Explosives Act (SprstG)	941.41	• Regulates traffic with explosives
• Radiological Protection Act (RPA)	814.50	• Protection of man and the environment against ionising radiations
• European Agreement on the International Transport of Dangerous Goods by Road (ADR)	0.741.621	• Protection of man and the environment from the transport of dangerous goods
<b>Federal ordinances</b>		
<a href="http://www.admin.ch/gov/en/start.html">www.admin.ch/gov/en/start.html</a> → Federal law → Classified compilation		
• Water Protection Ordinance (WPO)	814.201	• Storage and retention of water-hazardous materials
• Major Accident Ordinance (MAO)	814.012	• Protection of the population and the environment against serious damages
• Ordinance on the Transport of Dangerous Goods by Road (SDR) • Hazardous Goods Safety Officer Ordinance (GGBV)	741.621 741.622	• Transport and handling of dangerous goods
• Ordinance of Air Pollution Control (OAPC)	814.318.142.1	• Emission limits
• Waste Ordinance (AVDO)	814.600	• Waste Ordinance
• Ordinance on Traffic with Wastes (VeVA) • Ordinance of the DETEC on Lists for Traffic with Waste (LVA)	814.610 814.610.1	• Waste/special waste
• Ordinance on Accident Prevention (VUV)	832.30	• Handling and storage of highly dangerous liquids
• Chemicals Ordinance (ChemO)	813.11	• Protection against hazardous materials and preparations, handling, storage, safety data sheet, etc.
• Chemical Officer (Ordinance of the Federal Department of Home Affairs, EDI)	813.113.11	• Knowledge of handling of chemicals, issuing of information to authorities
• Ordinances 1 to 5 on the Labour Act (ArG, V1 to V5)	822.111 ff	• Health protection, work safety and plan approval
• Explosives Ordinance	941,411	• Traffic with explosives
<b>Cantonal laws and ordinances</b>		
<ul style="list-style-type: none"> <li>• on waste law</li> <li>• on labour law</li> <li>• on fire protection</li> </ul>	<ul style="list-style-type: none"> <li>• on chemicals law</li> <li>• on water protection</li> <li>• on accident prevention</li> </ul>	<ul style="list-style-type: none"> <li>• Cantonal laws and ordinances are usually obtainable through the Internet portal of the respective canton.</li> <li>• Furthermore, reference is made to the canton-specific supplement to this guideline!</li> </ul>

<sup>1</sup> Number of the classified compilation of the Federal Law of the Swiss Confederation

# 10 Regulations

## 10.2 Regulations, Guidelines and Check Lists

Regulations and check lists	Content / Topics
<b>VKF Fire Protection Standard</b> (BSN 1 to 15)	Terms, classification, protective measures, material separation, special rooms and zones, containers, alarms, action concept
<b>VKF Fire Protection Regulations</b> (BSR) <ul style="list-style-type: none"> <li>• 15-15 _____&gt;</li> <li>• 16-15 _____&gt;</li> <li>• 18-15 _____&gt;</li> <li>• 19-15 _____&gt;</li> <li>• 20-15 _____&gt;</li> <li>• 22-15 _____&gt;</li> <li>• 26-15 _____&gt;</li> </ul>	<ul style="list-style-type: none"> <li>• Fire protection in Switzerland, legal basis and liability</li> <li>• Fire safety distances, support structures, fire sections</li> <li>• Escape and rescue routes</li> <li>• Extinguishing equipment</li> <li>• Sprinkler systems</li> <li>• Fire alarm systems (requirements, necessity)</li> <li>• Lightning protection systems</li> <li>• Hazardous materials (definition, classification, basic principles, requirements) as well as other fire protection regulations not listed individually</li> </ul>
<b>FCOS regulations</b> <ul style="list-style-type: none"> <li>• 1825 _____&gt;</li> <li>• 6517 _____&gt;</li> <li>• 6501 _____&gt;</li> <li>• 6507 _____&gt;</li> <li>• 6508 _____&gt;</li> </ul>	<ul style="list-style-type: none"> <li>• Flammable liquids – storage and handling</li> <li>• Liquid gas</li> <li>• Acids and alkalis</li> <li>• Ammonia</li> <li>• Consultation of works physicians and other work safety experts</li> </ul>
<b>Suva check lists</b> <ul style="list-style-type: none"> <li>• 44007 _____&gt;</li> <li>• 67013 _____&gt;</li> <li>• 67068 _____&gt;</li> <li>• 67071 _____&gt;</li> <li>• 67084 _____&gt;</li> <li>• 67132 _____&gt;</li> </ul>	<ul style="list-style-type: none"> <li>• Safety identification</li> <li>• Handling of solvents (fire protection, explosion protection, intoxication)</li> <li>• Gas bottles, storage and handling</li> <li>• Storage of highly inflammable liquids</li> <li>• Acids and alkalis</li> <li>• Explosion risks (explosion protection document for SMEs)</li> </ul>
<b>Suva information leaflet</b> <ul style="list-style-type: none"> <li>• 2153 _____&gt;</li> </ul>	<ul style="list-style-type: none"> <li>• Explosion protection – Basic principles, minimum specifications, zones</li> </ul>
<b>Suva publications</b> <ul style="list-style-type: none"> <li>• 66122 _____&gt;</li> </ul>	<ul style="list-style-type: none"> <li>• Gas bottles (stores, ramps, gas distribution systems)</li> </ul>
<b>KVU enforcement folder for tank systems</b>	<ul style="list-style-type: none"> <li>• Regulations, information and schematic sheets for tank systems</li> <li>• Documents and information for enforcement, rules of technology etc.</li> </ul>
<b>ISSA publications</b> (International Social Security Association, Geneva)	<ul style="list-style-type: none"> <li>• Storage of chemicals (2012, ISBN 92-843-7036-1)</li> <li>• Practical aids for the compilation of the explosion protection document (2006)</li> </ul>
<b>Basle Chemical Industry (BCI)</b>	<ul style="list-style-type: none"> <li>• Tank Store Directives for the Chemical Industry, TRCI (Edition 2009)</li> </ul>
<b>Guideline «Fire Fighting Water Retention»</b>	<ul style="list-style-type: none"> <li>• Collection possibilities, technical, constructional and organisational measures, regulation for materials which can be water-hazardous in the case of fire</li> </ul>
<b>Guideline «Protection and Drainage of Goods Transshipment Points»</b>	<ul style="list-style-type: none"> <li>• Requirement for protection and possible solutions</li> </ul>
<b>Guideline «Storage of Agricultural Aids»</b>	<ul style="list-style-type: none"> <li>• Storage and transshipment of agricultural aids</li> </ul>
<b>SVS Directives</b> (Schweiz. Verein für Schweisstechnik – Swiss Association for Welding Technology)	<ul style="list-style-type: none"> <li>• RL 210.1, Regulations for the storage and handling of calcium carbide</li> <li>• Rules of Technology for Gases RG 450, «Plants with stationary, vacuum-insulated cryo-containers for non-flammable gases»</li> </ul>
<b>SVTI Schweiz. Verein für technische Inspektionen (Swiss Association for Technical Inspections)</b>	Tank and pipeline inspection body

# 11 Explanations

## 11.1 Terms

### Retention ponds

Retention ponds must be tight and resistant to the stored goods. They serve to detect and collect leaking liquids. Combined with a store frame, they help to keep an orderly storage place. Different systems are available on the market.

### Fire section (separate storage)

A fire section designates the area of a building which is surrounded by components that form a fire section (fire-resistant walls, ceilings and doors as well as bulkheads) to prevent the spreading of fire and smoke to other fire sections.

The formation of fire sections in buildings must be adapted the fire risk and fire load according to use. Store rooms for hazardous materials must always be designed as fire sections.

### Fire and explosion risk

The prerequisite for a fire or explosion is always the simultaneous presence of oxygen, energy (ignition source) and flammable material. Please bear in mind that it is not the liquid that burns but its vapours.

### Explosion limits

In mixtures of flammable gases and vapours with air, independent burning or explosion only take place within a certain concentration range between the lower and upper explosion limit.

### Explosion protection

If the ambient temperature exceeds the flash point of a material, its flammable vapours form an explosive atmosphere together with the ambient air. For this reason, further measures must be taken for all materials with a **flash point below 30 °C**.

- Electrical installations (distributors, sockets, etc.) and devices (e.g. lamps, forklift trucks) must be designed according to the defined Ex-zone and satisfy the required temperature class.
- The store must have adequate natural or artificial ventilation.

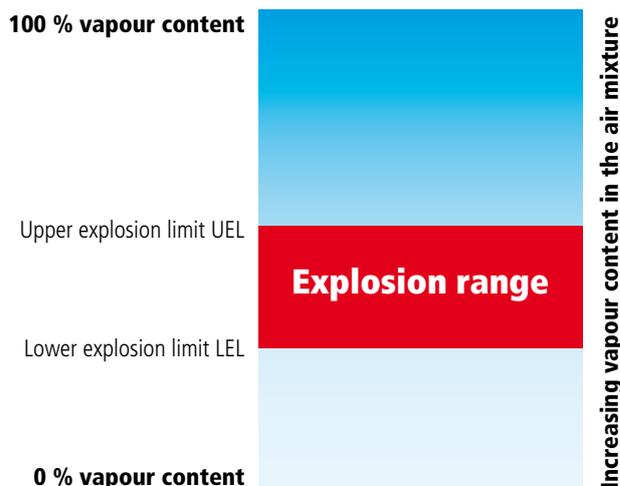
**Natural:** At least two non-lockable openings to the outside must be installed on opposite sides in rooms above ground level. One of the two openings must be directly but not more than 0.1 m above the floor. Every ventilation opening must be at least 20 cm<sup>2</sup> per m<sup>2</sup> of floor area.

**Artificial:** Fresh air and exhaust air from the outside (at least 3 times per hour). The ventilation must be in operation permanently or intermittently (e.g. 3 to 4 times; at least 10 minutes per hour) and additionally automatically when entering the store room. Alternatively, a ventilation (10-fold) controlled by a gas alarm system can be used.

- The assessment of the risks, the zone division and the implemented measures are recorded in an explosion protection document. The Suva 67071 check list can be used for storage of highly inflammable materials under simple conditions.



(Photo source: Environment Office, Ct. SO)



# 11 Explanations

## 11.1 Terms

### Ex zones

Ex zones (zones with a potential explosion risk) are areas in which explosive atmospheres can form due to the stored materials. Such atmospheres must be prevented. There must be no ignition sources in these areas. Ventilation, inerting, concentration monitoring, the use of closed systems as well as the earthing of all conductive parts are suitable measures for this. Only Ex-zone 2 is usually relevant for the storage of hazardous materials.

### Zone 2

Area in which, during normal operation, an explosive atmosphere as a mixture of air and flammable gases, vapours or mists normally does not occur or only temporarily.

The figure opposite shows Ex-zone 2 for the storage of highly inflammable liquids in rooms of normal height.



### Fire resistance

Components are assessed according to their behaviour in fire, especially according to their duration of fire resistance. This is the minimum time in minutes for which a component must meet the requirements. Essential requirements are:

<b>Load bearing capacity</b>	<b>R</b>
<b>Fire integrity</b>	<b>E</b>
<b>Thermal insulation</b>	<b>I</b>
<b>Fire resistance duration with regard to the individual requirements R, E or I</b>	<b>in minutes</b>

A supporting component of fire resistance class R 60 must be able to withstand the flames for 60 minutes.

Fire section EI 30 therefore means: Fire section with the requirement «Heat-insulating room enclosure» with a fire resistance of 30 minutes.

The behaviour in fire is also assessed in addition to the duration of fire resistance. Essential requirements here are:

- No contribution to fire RF1
- Low contribution to fire RF2
- Permissible contribution to fire RF3
- Impermissible contribution to fire RF4

# 11 Explanations

## 11.1 Terms

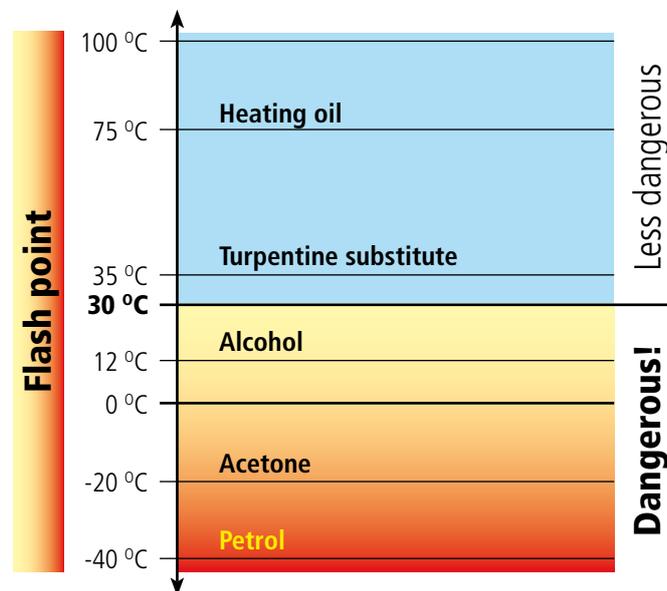
### Flash point

The flash point is the lowest temperature at which a liquid releases vapours to such an extent that they form a flammable mixture with the air above the liquid. The mixture will ignite in the presence of an ignition source.

### Caution:

Slightest contaminations by highly inflammable liquids can reduce the flash point of a relatively non-flammable liquid to a dangerous level (below 30 °C).

**Just 3 % petrol in heating oil will suffice to lower its flash point to below 20 °C. Be very careful when mixing solvents with different flash points!**



### Escape routes

The escape route is the shortest safe route available to persons to get from any point of the building to the outside. The escape route is also the access route for the fire service. Escape routes must be signposted and accessible at all times. Hazardous materials may not be stored along escape routes, corridors, thoroughfares or in the vicinity of entrances and exits.

### Globally Harmonized System (GHS)

GHS, the system for classification and labelling of chemicals encouraged by the United Nations (UN) stands as an abbreviation for «Globally Harmonized System of Classification and Labelling of Chemicals». The intended classification according to harmonized criteria should enable the hazards of chemicals to be communicated world-wide using the same symbols, hazard and safety notices on labels and in safety data sheets.

### Ground water protection zones, areas and water protection areas

Ground water protection zones serve to protect ground water collection and ground water enrichment systems. The three zones S1 (collection area), S2 (inner protection zone) and S3 (outer protection zone) are defined.

The water protection area  $A_u$  covers the usable underground water and peripheral areas, the water protection area  $A_o$  the surface water and its bank areas insofar as this is necessary to maintain an existing use.

The area of contribution  $Z_u$  covers the area from which approximately 90 per cent of the ground water originate, the area of contribution  $Z_o$  the area from which the largest part of the contamination of the surface water originates.

### H and P-statements

In addition to the hazard symbols, the CLP ordinance (GHS) also demands standard inscriptions which contain the information about the special hazards (H-statements, «Hazard Statements») as well as safety notices in the form of precautionary measures (P-statements, «Precautionary Statements») when handling the respective material.

Examples:

**H225** Highly flammable liquid and vapour;

**P210** Keep away from heat, sparks, open flames hot surfaces and other types of ignition sources. No smoking.

# 11 Explanations

## 11.1 Terms

### Classification according to GHS (CLP ordinance)

The GHS (Globally Harmonized System) is a classification and labelling system that allows dangerous chemicals to be classified and labelled comparably world-wide.

In Europe, the GHS is implemented according to the directive EU 1272/2008 (CLP Ordinance, Classification, Labelling and Packaging). Products are also labelled in Switzerland according to GHS in accordance with the Swiss chemicals law. The different types of hazards which can be presented by materials, preparations/mixtures or products (objects) are divided into hazard classes.

A distinction is made here between **physical hazards**, **health hazards** and **environmental hazards**.

### Classification codes according to ADR/RID

Hazardous materials and objects are assigned a classification code in the ADR. This indicates the hazardous properties in the form of letters.

Examples: **F** flammable  
**T** toxic  
**D** desensitised explosive materials  
**SR** self-reactive materials

### Retention measures

Escaping liquids (leakages) and contaminated fire fighting water which can lead to pollution of surface or underground waters may not be allowed to infiltrate the sewer system, waters or the ground. They must be retained. A distinction is made here between leakage retention and fire fighting water retention.

#### Leakage retention

Retention ponds and rooms which are designed as ponds, e.g. door thresholds, clad with steel basins or a steep descent away from the door are suitable for the retention of liquid spillages. The retention pond or the retention volume of the room should be able to accommodate at least the contents of the largest container. The primary aim of this measure is to prevent the spreading of liquid leakages to other rooms or store areas.

#### Fire fighting water retention

The store rooms themselves, the respective storey, the basement, sealed, sunken forecourts or separate fire fighting water ponds are suitable for retaining fire fighting water. The best solution is to conduct an analysis for developing a fire fighting water concept.

### Protective distances

A protective distance is to be understood as the minimum distance between buildings and/or facilities (e.g. public transport, tank installations etc.) which is required to avoid direct spreading of fires.

### Security plan

An appropriate security plan (in accordance with ADR section 1.10) must be drawn up for the storage of hazardous materials (high risk potential) for which the danger of misappropriation (e.g. for criminal or terrorist intents) exists. This should prevent misuse.

# 11 Explanations

## 11.1 Terms

### Special wastes

Special wastes in accordance with the Ordinance on Traffic with Wastes (VeVA) are wastes, the environmentally friendly disposal of which also requires special technical and organisational measures in domestic traffic because of their composition, their chemical-physical or biological properties. Special wastes are listed in appendix 1 of the directive of the DETEC on lists for traffic with wastes and marked with an S.

Special wastes are evaluated and assigned to a storage class based on their constituent materials. They must be stored according to their dangerous properties.

### Partial storage areas

A partial storage area is a floor area coherently occupied by stored goods which is separated from other partial storage areas by free lanes (more than 2.50 m) or walls. Shelves are also considered as partial storage areas.

### Warning signs

The Suva has defined warning signs which must be posted in the appropriate places. The following warning signs exist in connection with hazardous materials. They comply with the EN standard 7010.



Warning against toxic materials



Warning against corrosive substances



Warning against flammable materials



Warning against oxidizing substances



Warning against pressurized cylinders



Warning against explosive atmosphere

### Water hazard

Many liquids are considered potentially water-hazardous. These also include materials which can become water-hazardous liquids when mixed with water. The materials that are highly hazardous to water are recognisable from their classification according to the chemicals law.

Water-hazardous liquids are described by the following hazard statements in accordance with the GHS/CLP classification and labelling system:

H-statements	Meaning
<b>H400</b>	Very toxic to aquatic life
<b>H410</b>	Very toxic to aquatic life with long lasting effects
<b>H411</b>	Toxic to aquatic life with long lasting effects
<b>H412</b>	Harmful to aquatic life with long lasting effects
<b>H413</b>	May cause long lasting harmful effects to aquatic life

### Water hazard classes in Switzerland:

The Swiss Water Protection Act distinguishes between liquids which can contaminate water in small quantities and other water-hazardous liquids. The regulations on water hazardous liquids apply accordingly for materials which become water-hazardous when mixed with water or other liquids. Water-hazardous liquids are divided into two classes A and B. The classification is based on the classification system for chemicals (CLP) harmonized with the EU.

For example, materials that are highly hazardous to water according to CLP are classified with the hazard statements H400, H410 or H411 in class A.

[www.tankportal.ch](http://www.tankportal.ch) → Informationen as well as [www.kvu.ch](http://www.kvu.ch) → Arbeitsgruppen → Tank Schweiz (only accessible for enforcement authorities).

# 11 Explanations

## 11.1 Terms

### Water hazard classes in Germany:

The water-hazardous materials in Germany are divided into water hazard classes (WGK).

<http://www.umweltbundesamt.de> → Topics → Chemicals → Substances hazardous to waters  
as well as <http://webigoletto.uba.de/rigoletto>.

WHC	Description	Examples
<b>WHC 3</b>	highly hazardous to water	chromic acid, hydrogen cyanide, potassium cyanide
<b>WHC 2</b>	obviously hazardous to water	chloroacetic acid, ammonia solution, toluene
<b>WHC 1</b>	slightly hazardous to water	sodium hydroxide solution, hydrochloric acid, artificial fertilizer
<b>awg</b>	generally hazardous to water	fertiliser, liquid manure, silage seepage
<b>nwg</b>	non-hazardous to water	calcium carbonate, propane, bitumen

A detailed **on-line catalogue of classified materials exists** (see section 11.3 Internet).

## 11.2 Abbreviations

<b>AVDO</b>	Ordinance on the <b>A</b> voidance and <b>D</b> isposal of waste (Waste <b>O</b> rdinance) (SR 814.600)
<b>ADR</b>	European Agreement on the International Transport of Dangerous Goods by Road ( <b>A</b> ccord européen relatif au transport international des marchandises <b>D</b> angereuses par <b>R</b> oute)
<b>A<sub>0</sub>/A<sub>u</sub></b>	Water protection area A, surface and underground
<b>ArG</b>	Labour Act (SR 822.11)
<b>ASA</b>	Ordinance on the consultation of works physicians and other experts for work safety (FCOS directive no. 6508)
<b>BCI</b>	<b>B</b> asle <b>C</b> hemical <b>I</b> ndustry
<b>ChemA</b>	<b>C</b> hemicals <b>A</b> ct (SR 813.1)
<b>ChemO</b>	<b>C</b> hemicals <b>O</b> rdinance (SR 813.11)
<b>CLP</b>	EU chemicals directive on the classification, labelling and packaging of materials and mixtures ( <b>C</b> lassification, <b>L</b> abelling- <b>P</b> ackaging) (1272/2008)
<b>DETEC</b>	Federal <b>D</b> epartment of the <b>E</b> nvironment, <b>T</b> ransport, <b>E</b> nergy and <b>C</b> ommunication
<b>EPA</b>	<b>E</b> nvironmental <b>P</b> rotection <b>A</b> ct (SR 814.01)
<b>FCOS</b>	<b>F</b> ederal <b>C</b> oordination Commission for <b>O</b> ccupational <b>S</b> afety
<b>Flp.</b>	<b>F</b> lashpoint
<b>FOEN</b>	<b>F</b> ederal <b>O</b> ffice for the <b>E</b> nvironment
<b>FOPH</b>	<b>F</b> ederal <b>O</b> ffice of <b>P</b> ublic <b>H</b> ealth
<b>FWR</b>	<b>F</b> ire fighting <b>W</b> ater <b>R</b> etention

# 11 Explanations

## 11.2 Abbreviations

<b>GGB</b>	Hazardous Goods Safety Officer
<b>GGBV</b>	Hazardous Goods Safety Officer Ordinance (SR 741.622)
<b>GHS</b>	<b>G</b> lobally <b>H</b> armonized <b>S</b> ystem of Classification and Labelling of Chemicals
<b>IBC</b>	<b>I</b> ntermediate <b>B</b> ulk <b>C</b> ontainer
<b>IVSS/issa</b>	<b>I</b> nternationale <b>V</b> ereinigung für <b>s</b> oziale <b>S</b> icherheit/ <b>i</b> nternational <b>S</b> ocial <b>S</b> ecurity <b>A</b> ssociation
<b>KVU</b>	Conference of Heads of the Swiss Environment Offices
<b>LVA</b>	DETEC ordinance on lists for traffic with waste (SR 814.610.1)
<b>MAO</b>	<b>M</b> ajor <b>A</b> ccident <b>O</b> rdinance (SR 814.012)
<b>NH</b>	<b>N</b> on- <b>H</b> azardous materials
<b>OAPC</b>	<b>O</b> rdinance of <b>A</b> ir <b>P</b> ollution <b>C</b> ontrol (SR 814.318.142.1)
<b>PPE</b>	<b>P</b> ersonal <b>P</b> rotective <b>E</b> quipment
<b>REACH</b>	<b>R</b> egistration, <b>E</b> valuation, <b>A</b> uthorisation and Restriction of <b>C</b> hemicals
<b>RID</b>	Regulation governing the international railway transport of dangerous goods (Règlement concernant le transport international ferroviaire de marchandises dangereuses)
<b>RPA</b>	<b>R</b> adiological <b>P</b> rotection <b>A</b> ct (SR 814.50)
<b>S1/S2/S3</b>	Ground water protection zones and areas <b>S1</b> , <b>S2</b> and <b>S3</b> (Zones S)
<b>SC</b>	<b>S</b> torage <b>c</b> lass
<b>SDR</b>	Ordinance on the transport of dangerous goods by road (SR 741.621) (Ordonnance relative au transport des marchandises dangereuses par route)
<b>SECO</b>	State Secretariat for Economic Affairs
<b>SprstG</b>	Explosives Act (SR 941.41)
<b>SR</b>	Classified compilation of Swiss Federal Law
<b>Suva</b>	Swiss Accident Insurance Institute
<b>SVS/ASS</b>	Swiss Association for Welding Technology/Association suisse pour la technique du soudage
<b>SVTI/ASIT</b>	Swiss Association for Technical Inspections/Association suisse d'inspection technique contrôle
<b>TRGS</b>	Technical Rules for Hazardous Materials (Germany)
<b>UVG</b>	Accident Insurance Act (SR 832.20)
<b>VCI</b>	Association of the Chemical Industry (Germany)
<b>VeVA</b>	Ordinance on traffic with waste (SR 814.610)
<b>VKF</b>	Association of cantonal fire insurances
<b>VSA</b>	Association of Swiss waste water and water protection experts
<b>VUV</b>	Ordinance on accident prevention (SR 832.30)
<b>WGK</b>	Water hazard class
<b>WPA</b>	<b>W</b> ater <b>P</b> rotection <b>A</b> ct (SR 814.20)
<b>WPO</b>	<b>W</b> ater <b>P</b> rotection <b>O</b> rdinance (SR 814.201)
<b>Z<sub>o</sub>/Z<sub>u</sub></b>	Water protection area of distribution surface and underground

# 11 Explanations

## 11.3 Internet

Topic/Institution	Links
Cantonal offices for chemicals	<a href="http://www.chemsuisse.ch">www.chemsuisse.ch</a>
Common notification authority for chemicals	<a href="http://www.anmeldestelle.admin.ch">www.anmeldestelle.admin.ch</a>
Conference of Heads of Swiss Environment Offices (KVU)	<a href="http://www.kvu.ch">www.kvu.ch</a>
EcoServe International AG	<a href="http://www.ecoserve.ch">www.ecoserve.ch</a>
Expert Commission for Safety in the Swiss Chemical Industry (ESCIS)	<a href="http://www.escis.ch">www.escis.ch</a>
Federal Coordination Commission for Occupational Safety (FCOS)	<a href="http://www.ekas.ch">www.ekas.ch</a>
Federal Office of Public Health (FOPH)	<a href="http://www.bag.admin.ch">www.bag.admin.ch</a>
Federal Office for the Environment (FOEN)	<a href="http://www.bafu.admin.ch">www.bafu.admin.ch</a>
Fire protection regulations of the VKF (Association of Fire Insurance)	<a href="http://www.vkf.ch">www.vkf.ch</a>
German Environment Agency	<a href="http://www.umweltbundesamt.de">www.umweltbundesamt.de</a>
Information system for dangerous substances (IGS)	<a href="http://igs.naz.ch">http://igs.naz.ch</a>
International Social Security Association	<a href="http://www.issa.int/prevention-chemistry">www.issa.int/prevention-chemistry</a>
On-line catalogue of water-hazardous-classed materials	<a href="http://webrigoletto.uba.de/rigoletto">http://webrigoletto.uba.de/rigoletto</a>
Platform abfall.ch, information on the topic of wastes	<a href="http://www.abfall.ch">www.abfall.ch</a>
Professional Association of the Building Industry (Germany)	<a href="http://www.gisbau.de">www.gisbau.de</a>
Professional Association of the Raw Materials and Chemicals Industry (Germany)	<a href="http://www.gischem.de">www.gischem.de</a>
REACH-CLP Helpdesk (Germany)	<a href="http://www.reach-clp-helpdesk.de">www.reach-clp-helpdesk.de</a>
REACH-Compliance GmbH	<a href="http://www.reach-compliance.ch">www.reach-compliance.ch</a>
Safety data sheets	<a href="http://www.eusdb.de">www.eusdb.de</a>
State Secretariat for Economic Affairs	<a href="https://www.seco.admin.ch">https://www.seco.admin.ch</a>
Swiss Association for Technical Inspections (SVTI)	<a href="http://www.svti.ch">www.svti.ch</a>
Swiss Association for Welding Technology (SVS)	<a href="http://www.svsxass.ch">www.svsxass.ch</a>
Swiss National Accident Insurance Fund (Suva)	<a href="http://www.suva.ch">www.suva.ch</a>
Swiss Safety Center AG	<a href="http://www.safetycenter.ch">www.safetycenter.ch</a>
Swiss Water Association	<a href="http://www.vsa.ch">www.vsa.ch</a>
Tox Info Suisse	<a href="http://www.toxi.ch">www.toxi.ch</a>
Wastes and special wastes/waste coding and company addresses	<a href="http://www.veva-online.ch">www.veva-online.ch</a>

## 12 In Seven Steps to the Store Concept

### Step 1: Creation of a full store list

Which materials and products (product designation) are stored?

### Step 2: Add classifications and hazardous properties to the list

How are the stored materials and products classified and what hazardous properties do they have?  
GHS labelling and hazard statements, water hazard class WHC (see section 11.1, page 41/42) and flash point Flp. (See section 11.1, page 39).

### Step 3: Add maximum storage quantities to the list

What are the maximum stored quantities of materials and products?

### Step 4: Determine the appropriate storage classes (based on the procedural sequence on pages 18/19)

Product designation	GHS Hazard statements									Flp. °C	*	WHC	Max. storage quantity		SC
													Container	kg	
Material A	300, 330, 410				X				X	140	A	3	10 boxes	24	<b>6.1</b>
Material B	226		X							42	B	1	84 canisters	400	<b>3</b>
Material C	314							X		---	B	1	72 canisters	720	<b>8</b>
Material D	319, 410						X		X	78	A	3	64 canisters	640	<b>10/12</b>
Material E	317						X			---	B	nwg	130 boxes	740	<b>11/13</b>
Material F	318							X		---	B	1	80 buckets	800	<b>8</b>
Material G	225, 319, 336		X				X			-22	B	1	2 IBC	1,800	<b>3</b>
Material H	---									160	B	1	10 barrels	1600	<b>10/12</b>
Material I	220, 280	X	X							-104	B	nwg	10 bottles	120	<b>2</b>

\* = Swiss classification for water-hazardous liquids

### Step 5: Assign the storage quantities to the corresponding storage classes

Product designation	SC 2 (kg)	SC 3 (kg)	SC 6.1 (kg)	SC 8 (kg)	SC 10/12 (kg)	SC 11/13 (kg)
Material A			<b>24</b>			
Material B		<b>400</b>				
Material C				<b>720</b>		
Material D					<b>640</b>	
Material E						<b>740</b>
Material F				<b>800</b>		
Material G		<b>1,800</b>				
Material H					<b>1,600</b>	
Material I	<b>120</b>					
<b>Total</b>	<b>120</b>	<b>2,200</b>	<b>24</b>	<b>1,520</b>	<b>2,240</b>	<b>740</b>

## 12 In Seven Steps to the Store Concept

### Step 6: Determine the requirements for the store rooms

Fire sections, ventilation, leakage retention, fire fighting water retention FWR, Ex-protection etc. (according to section 8, pages 22 to 32)

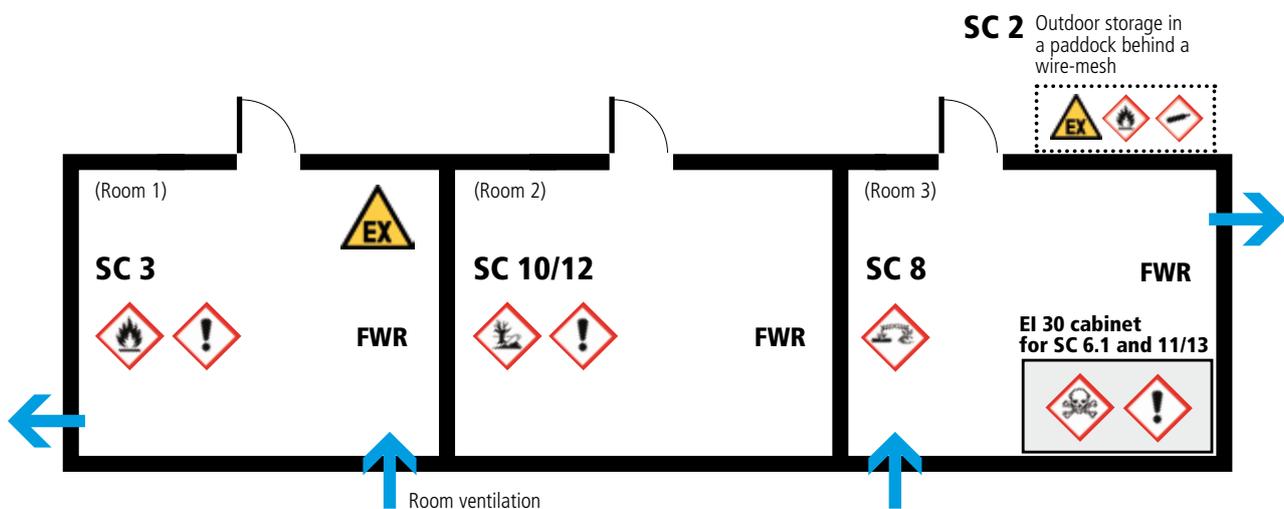
Storage class	Storage quantity (kg)	Evaluation of joint storage	Other requirements
2	120	Separate storage	<ul style="list-style-type: none"> <li>Outdoor wire-mesh paddock</li> <li>Ex-protection</li> </ul>
3	2,200	Separate storage	<ul style="list-style-type: none"> <li>Ex-protection</li> <li>Ventilation</li> <li>Leakage retention</li> <li>Fire fighting water retention *</li> </ul>
6.1	24	Segregated storage with SC 8, 10/12 or 11/13 (clarify)	<ul style="list-style-type: none"> <li>Ventilation *</li> <li>Leakage retention</li> </ul>
8	1,520	Separate storage	<ul style="list-style-type: none"> <li>Ventilation *</li> <li>Leakage retention</li> <li>Fire fighting water retention *</li> </ul>
10/12	2,240	Separate storage	<ul style="list-style-type: none"> <li>Leakage retention</li> <li>Fire fighting water retention</li> </ul>
11/13	740	Separate storage, possibly segregated with SC 8 or 10/12	

\* Clarify individually

### Step 7: Transpose the results to the building planning

The listed products can be stored as follows (regularly check that information is up to date):

- The products of SC 2 are stored outdoors in a wire-mesh paddock.
- For SC 3, a separate fire section EI 90 is necessary (room 1) because the storage quantity is above 2,000 litres.
- For SC 10/12, a separate fire section EI 60 is necessary (room 2).
- For SC 8, a fire section of at least EI 60 is necessary (because more than 1,000 kg) (room 3).
- The small quantities of SC 6.1 and 11/13 can be stored in a hazardous materials cabinet (at least EI 30) in room 3. The products of SC 6.1 must be stored on a separate retention pond in the cabinet which can accommodate at least the volume of the largest container.



For implementation, see also storage concept list 1, page 48

## 12 In Seven Steps to the Store Concept

### Possibility of material quantity reduction (store variant for implementing step 7)

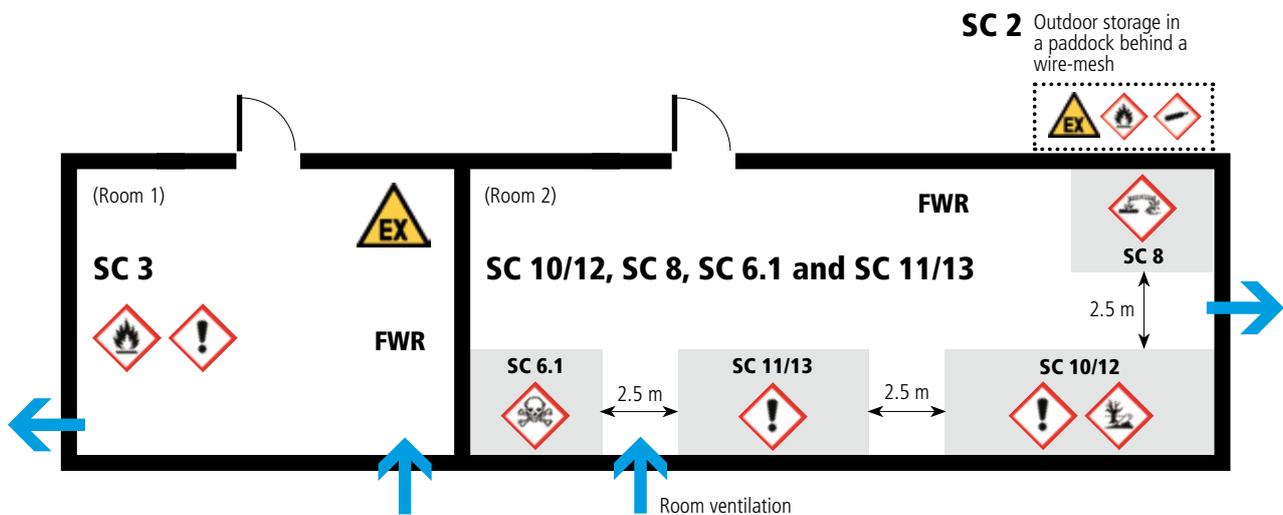
What effects the reduction of the material quantities can have is shown by the following situation in which the quantities of storage class 8, 10/12 and 11/13 have been reduced based on the previous example.

Storage class	Storage quantity (kg)	Evaluation of joint storage	Other requirements
2	120	Separate storage	<ul style="list-style-type: none"> <li>Outdoor wire-mesh paddock</li> <li>Ex-protection</li> </ul>
3	2,200	Separate storage	<ul style="list-style-type: none"> <li>Ex-protection</li> <li>Ventilation</li> <li>Leakage retention</li> <li>Fire fighting water retention *</li> </ul>
6.1	24	Segregated storage with SC 8, 10/12 or 11/13 (clarify)	<ul style="list-style-type: none"> <li>Ventilation *</li> <li>Leakage retention</li> </ul>
8	200	Segregated storage with SC 6.1, 10/12 or 11/13	<ul style="list-style-type: none"> <li>Ventilation *</li> <li>Leakage retention</li> </ul>
10/12	500	Segregated storage with SC 6.1, 8 or 11/13	<ul style="list-style-type: none"> <li>Leakage retention</li> <li>Fire fighting water retention</li> </ul>
11/13	250	Segregated storage with SC 6.1, 8 or 10/12	

\* Clarify individually

The products described above can be stored as follows:

- The products of SC 2 are stored outdoors in a wire-mesh paddock.
- For SC 3, a separate fire section EI 90 is necessary (room 1) because the storage quantity is above 2,000 litres.
- A fire section of at least EI 30 (room 2) is necessary for the other storage classes. Segregated storage of SC 6.1, 8, 10/12 and 11/13 is possible in this room because the whole storage quantity is less than 1,000 kg. Subject to material-specific joint storage prohibitions. The products must be stored per storage class (SC) in defined storage areas on **separate retention ponds (outlined in grey)**. Safety distances (2.5 m) must be kept between the storage areas or shielding walls must be erected.



For implementation, see also storage concept list 2, page 48

## 12 In Seven Steps to the Store Concept

### Store concept list 1

Store room	SC	Storage quantity	Hazard symbols	Measures	Remark
<b>Room 1</b>	SC 3	2,200 kg	 	Separate fire section EI 90 <ul style="list-style-type: none"> <li>• Ventilation</li> <li>• Lightning protection system</li> </ul>	Storage quantity above 2,000 litres
<b>Room 2</b>	SC 10/12	2,240 kg	 	Separate fire section EI 60	-----
<b>Room 3</b>	SC 8	1,520 kg		Separate fire section EI 60	-----
<b>Cabinet in room 3</b>	SC 6.1 SC 11/13	24 kg 740 kg	 	<ul style="list-style-type: none"> <li>• Cabinet EI 30</li> <li>• Separate retention pond</li> </ul>	Joint storage with SC 6.1 and 11/13 possible, because small quantity SC 6.1 (24 kg)
<b>Wire-mesh paddock outdoors</b>	SC 2	120 kg	 	<ul style="list-style-type: none"> <li>• Outdoor wire-mesh paddock</li> </ul>	Ventilation ensured by wire mesh

### Store concept list 2 (material quantity reduction)

Store room	SC	Storage quantity	Hazard symbols	Measures	Remark
<b>Room 1</b>	SC 3	2,200 kg	 	Separate fire section EI 90 <ul style="list-style-type: none"> <li>• Ventilation</li> <li>• Lightning protection system</li> </ul>	Storage quantity above 2,000 litres
<b>Room 2</b>  Caution: Keep safety distance of 2.5 m or erect shielding walls	SC 10/12	500 kg	 	Separate fire section EI 60 <ul style="list-style-type: none"> <li>• Separate retention pond</li> </ul>	-----
	SC 8	200 kg		<ul style="list-style-type: none"> <li>• Separate retention ponds (segregated for acids/alkalis) in the same fire section EI 60</li> </ul>	-----
	SC 6.1 SC 11/13	24 kg 250 kg	 	<ul style="list-style-type: none"> <li>• Separate retention ponds in the same fire section EI 60</li> </ul>	Segregated storage of SC 6.1 and 11/13 possible because small quantity SC 6.1 (24 kg)
<b>Wire-mesh paddock outdoors</b>	SC 2	120 kg	 	<ul style="list-style-type: none"> <li>• Outdoor wire-mesh paddock</li> </ul>	Ventilation ensured by wire mesh

## 13 Check List

### For all storage classes

The following check lists serve for completion of the technical and operational measures for an orderly stores operation. Where a question is answered with “**NO**”, it may have to be clarified with the responsible technical department or another safety specialist what measures are to be taken.

up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg	Check list for all storage classes		YES	NO
			<input type="checkbox"/>	not obligatory but recommended		
			<input checked="" type="checkbox"/>	clarify possible necessary measures in consultation with an expert		
			<input checked="" type="checkbox"/>	necessary measures		
<b>x</b>	<b>x</b>	<b>x</b>		Are you familiar with the safety-relevant properties of the materials stored in your company (flash point etc.)?	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Are the safety data sheets available for every material?	<input type="checkbox"/>	<input type="checkbox"/>
<b>(x)</b>	<b>x</b>	<b>x</b>		Are the joint storage prohibitions observed?	<input type="checkbox"/>	<input type="checkbox"/>
<b>(x)</b>	<b>x</b>	<b>x</b>		Have you created a store concept?	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Is the store clearly arranged?	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Are the goods stored separately from other goods? Note: Do not store in the vicinity of foodstuffs, fodder and medicines.	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Are all storage containers labelled and identified correctly?	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Do all storage containers have sufficient mechanical, thermal and chemical resistance?	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Are all storage containers undamaged and tightly sealed?	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Are the storage cabinets and rooms marked by the appropriate hazard notices?	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>				Is the storage cabinet a non-flammable or flame-retardant version with retention ponds?	<input type="checkbox"/>	<input type="checkbox"/>
	<b>(x)</b>	<b>x</b>		Does the store room form a separate fire section of at least EI 60?	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Are the furnishings in the store (e.g. shelves) made of suitable material?	<input type="checkbox"/>	<input type="checkbox"/>
	<b>x</b>	<b>x</b>		Do all stores have sealed floors? Note: The storage of hazardous materials on unsealed floors is not allowed.	<input type="checkbox"/>	<input type="checkbox"/>
<b>(x)</b>	<b>x</b>	<b>x</b>		Is leakage detection/retention possibility ensured? Note: A retention pond is absolutely essential if the floor has a drain.	<input type="checkbox"/>	<input type="checkbox"/>
	<b>x</b>	<b>x</b>		Are store furnishings which could present a hazard if physically damaged adequately protected?	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Are escape routes and emergency exits marked and accessible at all times?	<input type="checkbox"/>	<input type="checkbox"/>
<b>(x)</b>	<b>x</b>	<b>x</b>		Is a roof available for outdoor storage and are the prescribed safety distances kept?	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Are the responsibilities clearly regulated?	<input type="checkbox"/>	<input type="checkbox"/>

# 13 Check List

## For all storage classes

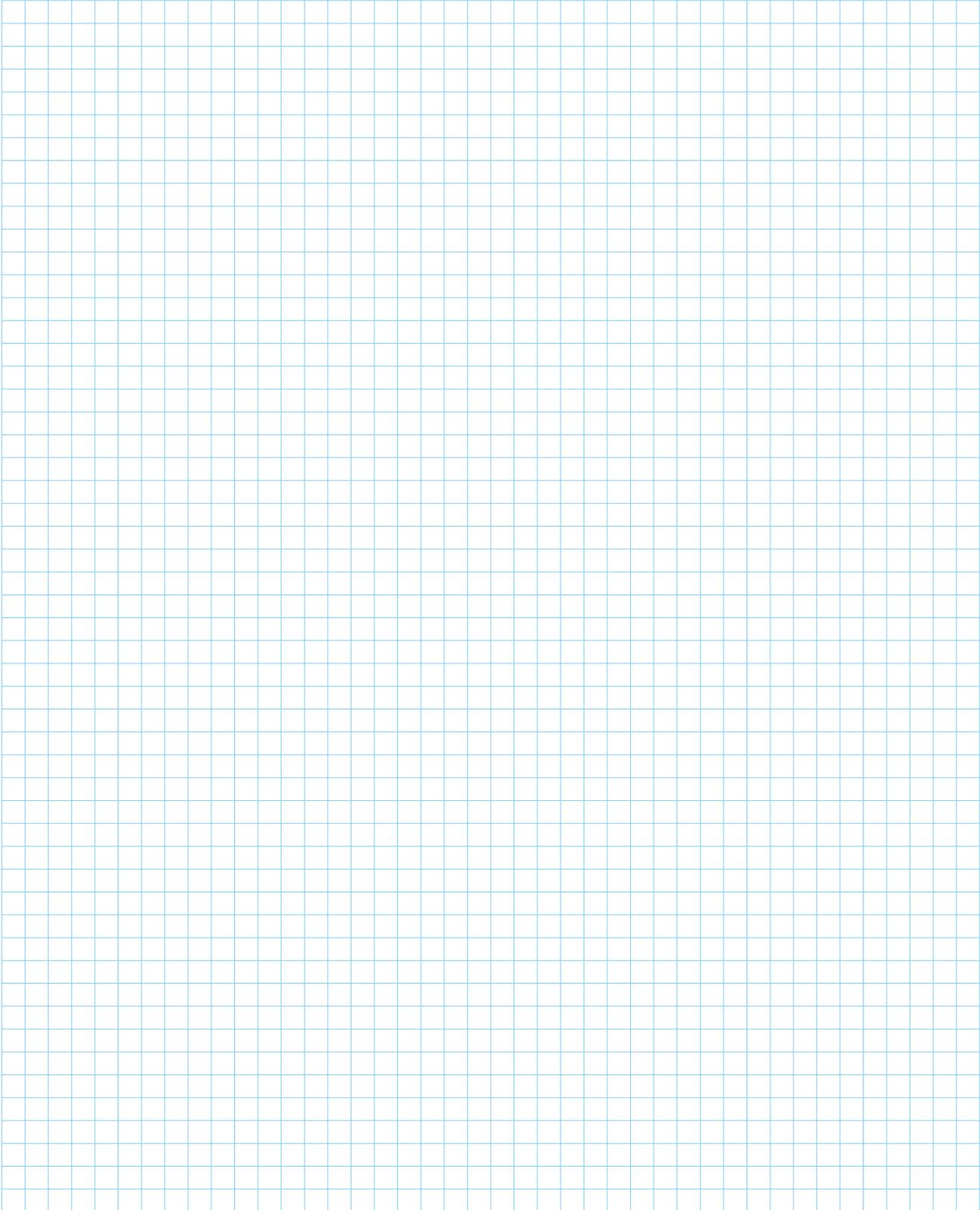
up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg	<b>Check list for all storage classes</b>			YES	NO
			<input type="checkbox"/>	(x)	x		
			<input type="checkbox"/>	not obligatory but recommended			
			<input type="checkbox"/>	(x) clarify possible necessary measures in consultation with an expert			
			<input type="checkbox"/>	x necessary measures			
x	x	x		Has a safety officer been appointed?	<input type="checkbox"/>	<input type="checkbox"/>	
	x	x		Are rules of conduct and operating instructions recorded in writing?	<input type="checkbox"/>	<input type="checkbox"/>	
(x)	x	x		Do you keep an up-to-date, readily available store list?	<input type="checkbox"/>	<input type="checkbox"/>	
x	x	x		Are all store and danger areas signposted?	<input type="checkbox"/>	<input type="checkbox"/>	
x	x	x		Do you record regular store inspections in writing?	<input type="checkbox"/>	<input type="checkbox"/>	
	(x)	x		Is there an emergency plan for the rescue services?	<input type="checkbox"/>	<input type="checkbox"/>	
x	x	x		Are the stored products only accessible to authorised persons?	<input type="checkbox"/>	<input type="checkbox"/>	
x	x	x		Is the store secured against arson?	<input type="checkbox"/>	<input type="checkbox"/>	
(x)	x	x		Is smoking prohibited?	<input type="checkbox"/>	<input type="checkbox"/>	
(x)	x	x		Are binding agents and disposal containers at the ready for any spillages of hazardous materials?	<input type="checkbox"/>	<input type="checkbox"/>	
x	x	x		Are any leakages cleared up immediately and disposed of properly?	<input type="checkbox"/>	<input type="checkbox"/>	
x	x	x		Are the suitable extinguishing agents available in your store? Note: Not all hazardous materials may/can be extinguished with water!	<input type="checkbox"/>	<input type="checkbox"/>	
	x	x		Is appropriate personal protective equipment (PPE) for the stored goods available at all times?	<input type="checkbox"/>	<input type="checkbox"/>	
x	x	x		Are the emergency phone numbers as well as the first aid measures in the event of intoxications and acid burns posted prominently?	<input type="checkbox"/>	<input type="checkbox"/>	
x	x	x		Is a first aid cabinet available?	<input type="checkbox"/>	<input type="checkbox"/>	
(x)	x	x		Is an eye shower or equivalent available at all times?	<input type="checkbox"/>	<input type="checkbox"/>	
x	x	x		Are the employees trained and instructed regularly?	<input type="checkbox"/>	<input type="checkbox"/>	
	x	x		Storage in ground water protection zone S3 and ground water protection areas is only allowed with official permission. Has this been obtained?	<input type="checkbox"/>	<input type="checkbox"/>	
	x	x		Storage in the water protection areas A and Z must be reported to the authorities or permitted by them. Has this been done?	<input type="checkbox"/>	<input type="checkbox"/>	
	(x)	x		Have the threshold quantities according to the Major Accident Ordinance been clarified?	<input type="checkbox"/>	<input type="checkbox"/>	
	(x)	x		Has a summary report been written on exceeding the threshold quantities according to the Major Accident Ordinance?	<input type="checkbox"/>	<input type="checkbox"/>	
		x		Have you taken the fire protection directive "Hazardous Materials 26-15" and the "Guideline for practice for fire fighting water retention" into consideration in the evaluation of the store?	<input type="checkbox"/>	<input type="checkbox"/>	

# 13 Check List

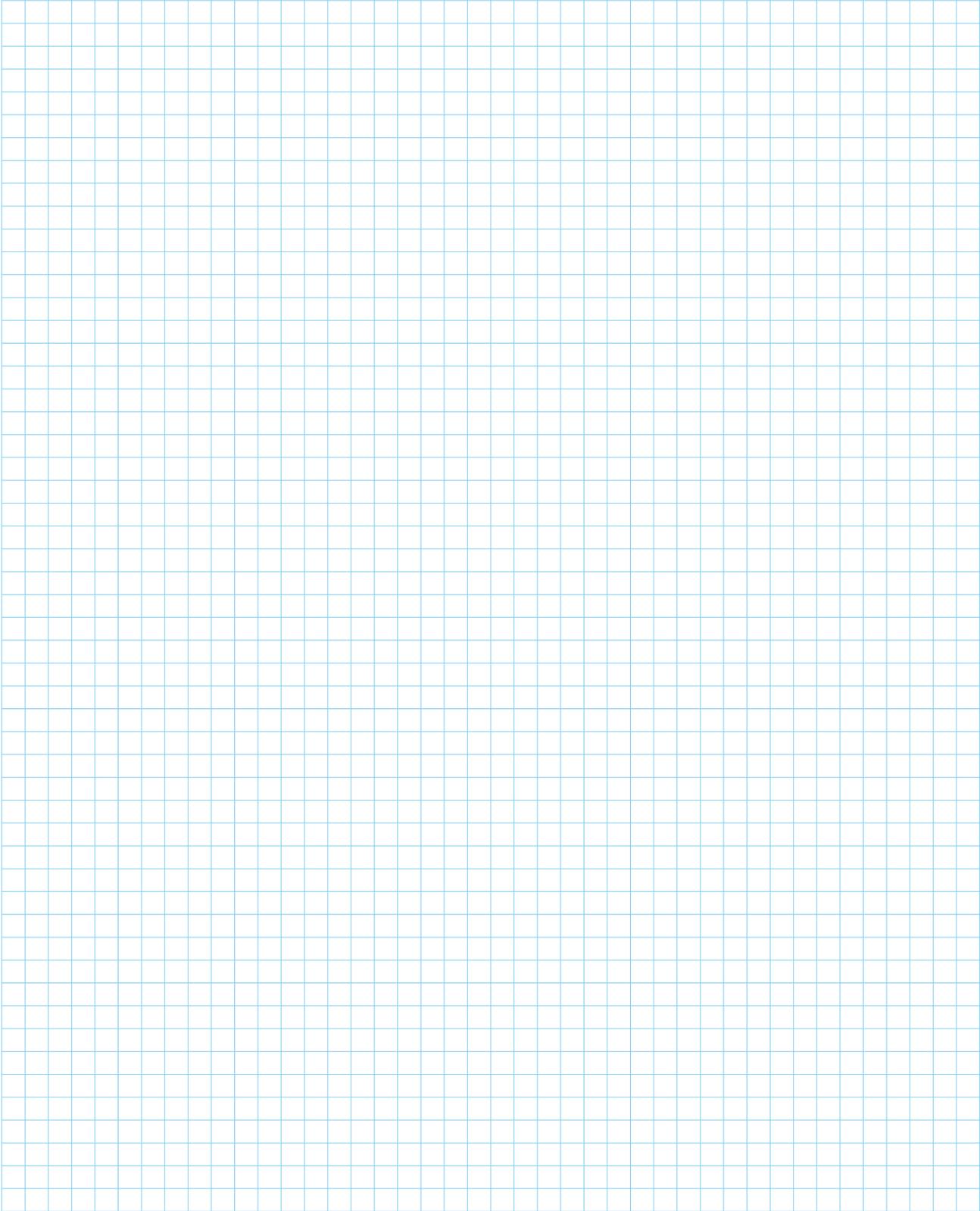
## Storage class-specific

up to approx. 100 kg	approx. 100 to approx. 1,000 kg	more than approx. 1,000 kg	Check list for specific storage classes		YES	NO
			<input type="checkbox"/>	not obligatory but recommended		
			<input checked="" type="checkbox"/>	clarify possible necessary measures in consultation with an expert		
			<input checked="" type="checkbox"/>	necessary measures		
	<b>x</b>	<b>x</b>		Are Ex-zones in the store clarified and assigned if necessary? → SC 2 (flammable gases), (5), 3	<input type="checkbox"/>	<input type="checkbox"/>
	<b>x</b>	<b>x</b>		Has an Ex-protection document been compiled where necessary? → SC 2 (flammable gases), (5), 3	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Are the special store concepts for the toxic gases created and observed? → SC 2 (toxic gases), (5), 3	<input type="checkbox"/>	<input type="checkbox"/>
	<b>x</b>	<b>x</b>		Have sufficient fire fighting water retention measures been taken where necessary? → SC 3, 4.1, 4.2, 4.3, 5, 6.1, 8, 10/12, 11/13	<input type="checkbox"/>	<input type="checkbox"/>
	<b>x</b>	<b>x</b>		Have the ventilation measures been taken? → SC 2, 3, (6.1), 8	<input type="checkbox"/>	<input type="checkbox"/>
	<b>x</b>	<b>x</b>		Do the floors have suitable chemical resistance for the stored materials? → SC 3, 4.1, 4.2, 4.3, 5, 6.1, 8, 10/12, 11/13	<input type="checkbox"/>	<input type="checkbox"/>
	<b>x</b>	<b>x</b>		Do the store rooms form drainless ponds with a minimum retention volume that corresponds to the content of the largest storage container? Note: Drain into a company accident or fire fighting water retention pond is equivalent. → SC 2 (gases heavier than air), 3, 4.2, 4.3, 5, 6.1, 8, 10/12	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Are the products only stored in the original containers? → SC 4.2, 4.3, 5	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Is a regular temperature check made? → SC 4.2, (5)	<input type="checkbox"/>	<input type="checkbox"/>
<b>x</b>	<b>x</b>	<b>x</b>		Are the containers protected against wet? → SC 4.3	<input type="checkbox"/>	<input type="checkbox"/>
	<b>x</b>	<b>x</b>		Is the "Do not extinguish with water" notice posted? → SC 4.3	<input type="checkbox"/>	<input type="checkbox"/>

**Notes, store diagram**



**Notes, store diagram**



## 14 Supplements

Supplement 1: Procedural sequence for identification of hazardous materials and their storage class assignment

Supplement 2: Joint storage tables «General joint storage of hazardous materials»

Supplement 3: Canton-specific supplement (if available)



