



Practical Chemical Management Toolkit for your Company

Module 1 – Inventory and risk assessment under the umbrella of resource efficiency and cleaner production

General information on the GIZ Convention Project Chemical Safety

Chemistry plays an important role in modern society and therefore in development and development co-operation. There are both dangers and benefits in dealing with chemicals. The GIZ Convention Project Chemical Safety was launched on behalf of the **German Ministry for Economic Cooperation and Development (BMZ)** in 1997.

The main aims are to assist developing countries and companies in developing countries with the treatment and final disposal of hazardous chemicals (primarily persistent organic pollutants), especially in the form of pesticides, and to assist with the implementation of the concepts of chemical safety and chemical management as well as to improve work safety, competitiveness and cleaner production processes in small and medium size enterprises (SMEs).

Activities today focus on strengthening local capacities and public and private sector levels for hazardous waste disposal (consulting, execution and capacity building), sound chemicals management (e.g. development and implementation of training) as well as supporting the German Federal Ministry for Economic Cooperation and Development (BMZ) in developing concepts for international development cooperation in the context of cleaner production, resource efficiency and international conventions and agreements (Stockholm, Rotterdam, Basel, SAICM etc.).

Practical Chemical Management Toolkit for your Company

Module 1 – Inventory and Risk Assessment under the Umbrella of Resource Efficiency and Cleaner Production

Module 2 – Managing the chemical risks in your company – control measures and gap analysis

Module 3 – Hazardous Waste Management

This toolkit has been developed for companies particularly in developing countries to translate the requirements under the various international chemical conventions and agreements into practical steps. It provides managers, supervisors as well as workers involved in the various aspects of managing chemicals with a ready reference to address the challenges of handling chemicals substances in a sound and responsible manner. It refers to a number of practical measures that they can undertake on their own to implement a practical and successful chemical management in their operations.

Also separate trainer manuals are available for each training module to support local consultants/ facilitators, interested in offering chemical management related support services.

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Acknowledgements

The method of linking Risk Phrases (R-Phrases) with classification into hazard groups and the identification of needed control approaches for chemicals that can cause harm when inhaled described in this Guide is based on the approach of the ILO Safe Work Chemical Control Toolkit © 2001 produced by the Geneva-based International Labor Organization (ILO) working in collaboration with the International Occupational Hygiene Association (IOHA) and Health and Safety Executive (HSE) in the UK. The permission to integrate this approach into the guide is gratefully acknowledged.

The skin risk assessment information used in the guide which follow the concept of ILO's control banding approach have been further developed and updated by the German Federal Institute for Occupational Safety and Health (BAuA). We also acknowledge the permission for the use of tables 1 and 2 in module 1 and tables 1, 2 and 3 in module 2. Furthermore we are grateful to BAuA for permitting the inclusion of its newly developed tool for assessing the risk of fire and explosion caused by chemicals (under BAuA evaluation until 2012). The permission to integrate this approach into the guide is gratefully acknowledged.

Hint



This sign in the text of the guide indicates that you can read more about a specific topic. Click on it to go to the specific topic.

1. GIZ Chemical Management Toolkit in brief

The GIZ Chemical Management Toolkit refers to a number of practical measures that enterprises can undertake on their own to implement practical and successful chemical management in their operations. This toolkit is primarily meant as a ready reference and guidance for managers, supervisors as well as workers involved in the various aspects of properly managing chemicals in an enterprise.

The implementation of the different elements of the toolkit, with links to the management of production, environmental health and safety and organizational improvements, will allow the enterprises to improve their productivity and reduce costs through an improved use of chemicals. In addition, the enterprises will benefit from organizational improvements -as the implementation of chemical management elements helps to establish means for better internal communication and to set clear responsibilities as well as laying the foundation for the implementation of certified management systems for quality, environment and health & safety. Implementing the chemical management will improve the enterprises' workplace safety and environmental performance by addressing issues of safe handling and disposal of chemicals throughout the enterprises.

Being in line with international conventions and recommendations (such as ILO 170 on Safe Use of Chemicals at Work), which in turn form the basis of many national legislations and common codes of conduct, the implementation of the practical GIZ Chemical Management approach allows the enterprises to strive for compliance with the respective national legal requirements as well as for meeting customer requirements with regard to the sound handling of chemicals.

In order not to "overstrain" the enterprises financially and technically, the GIZ Chemical Management toolkit guides the enterprises through a step-to-step approach towards achieving sound chemicals management. Some enterprises may have several of the chemical management elements already in place. Such enterprises can use the guide to evaluate the existing elements for possible gaps and scope for improvement.

The first step focuses on getting a clear picture of the processes in the enterprise as well as the different chemicals used therein. This includes the elaboration of a detailed chemical inventory. With the help of this inventory, the enterprise will be able to get a full picture of the situation with regard to the use and flow of chemicals within the operations, while identifying redundant products, unknown substances, expired chemicals or very hazardous substances.

Based on the inventory, the enterprise will be able to apply a simple assessment tool to identify hazardous chemicals and categorize these by their level of hazard so as to allow for a prioritization of possible follow-up action.

As a second step, the toolkit will guide the enterprise towards identifying critical areas and situations with regard to the handling of chemicals and cost savings as well as to decide on the proper controls and intervention methods to address these areas and situations. This step also includes the elaboration of action plans based on clear and verifiable goals, which allow the enterprise to easily implement and monitor the progress of improvement measures, for example technical controls, organizational changes and training. The third step focuses on the implementation of measures, which will allow the enterprises to launch into a continuous improvement of chemical management, planning, implementing and evaluating actions, communicating and rewarding results, monitoring results and establishing new targets. The toolkit looks at both the safe handling of chemicals and the disposal of chemicals, particularly hazardous ones, in the enterprise.

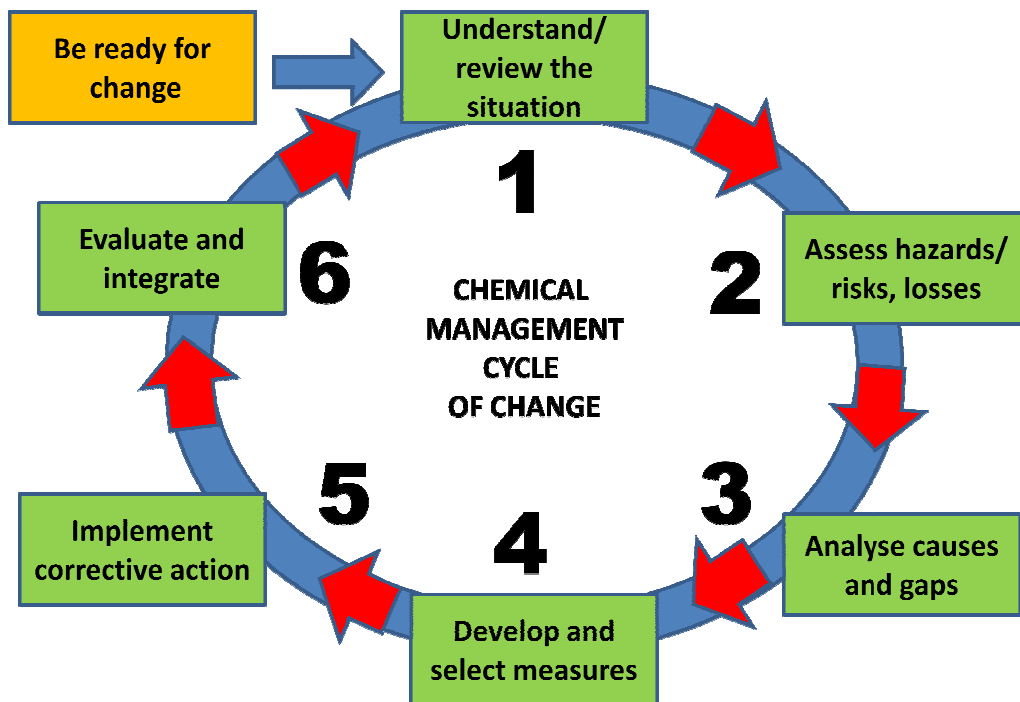
To further support the gradual implementation of the approach, the GIZ Chemical Management Toolkit provides readily usable tools and references (in form of handouts) for each step, such as input-output analyses of production processes, using safety data sheets, doing risk assessments and identification of recommended and assessing existing control approaches (based on the ILO control banding principles), and systematically planning, monitoring and documenting improvement measures.

Enterprises have the option of either applying the toolkit on their own or seeking initial support from an external trainer/advisor, who acts as a guide and coach to the enterprise company throughout the step-by-step implementation,

enabling the enterprises to continue to apply the GIZ Chemical Management Toolkit on their own thereafter. Smaller companies, particularly if they are located in close geographical vicinity (e.g. in industrial clusters or estates), can also consider a group training/guidance approach. Such training is organized in the form of several short training sessions, spread out over a period of about six months.

Each training session combines case-based learning to familiarize the participants with the individual tools, followed by the practical application of these tools in the respective companies under the guidance of the trainer(s). Each session consists of 1 – 1 ½ days training in a class-room settings and 1 ½ - 2 days application in the company. However, the modular approach allows a flexible adaptation of the times to suit the participating companies (e.g. evening sessions, weekend sessions).

The approaches and concepts presented here have already been implemented successfully in enterprises in Indonesia, India, Bangladesh, Vietnam, Egypt, Morocco, South Africa, Chile and Colombia.



Going into action

You will now take the first steps towards chemical management in your company and start creating the fundament for your chemical management system. During these steps you will find answers to questions such as

- What chemicals do I use in my company?
- Where are these chemicals present and used?
- Which of these chemicals are hazardous?
- How may these hazardous chemicals affect me/other workers?
- How do I get more information about these chemicals?
- Are there any areas for immediate improvement?
- Where can I save money from improved handling of chemicals?

What steps are involved?

To answer these questions and create the fundament for the chemical management, we suggest that you will go through all of the following steps:

Step		Activities
Step 1	Understand and review the situation in your company and systematically identify and document all chemical substances stored and in use in your enterprise	<ul style="list-style-type: none"> • Conduct a material flow analysis • Identify and quantify the most important Non-Product-Outputs (NPOs) in your factory, with special focus on chemicals used • Identify areas, which may need immediate attention (“hot spots”) and take corrective action • Document your findings in such a way as to allow your colleagues and workers to participate in the process • Identify the chemicals stored and in use in the different parts of your enterprise • Explore which information is already available on these chemicals and what might be missing • Collect missing information on chemicals
Step 2	Identify and assess the hazards and risks of the different chemicals	<ul style="list-style-type: none"> • Categorise the chemicals identified by type of their hazard(s) • Collect and analyse information on how the chemicals are used in your enterprise • Assess the hazard and risks • Consolidate your chemical inventory
Step 3	Create a structured information base in form of a chemical inventory	<ul style="list-style-type: none"> • Enter the data in the form of a standardised format • Complement the documentation, adding missing safety data sheets • Develop procedure(s) for updating and maintaining the chemical inventory • Identify hazard groups and recommended control approaches

What you will get out of this module

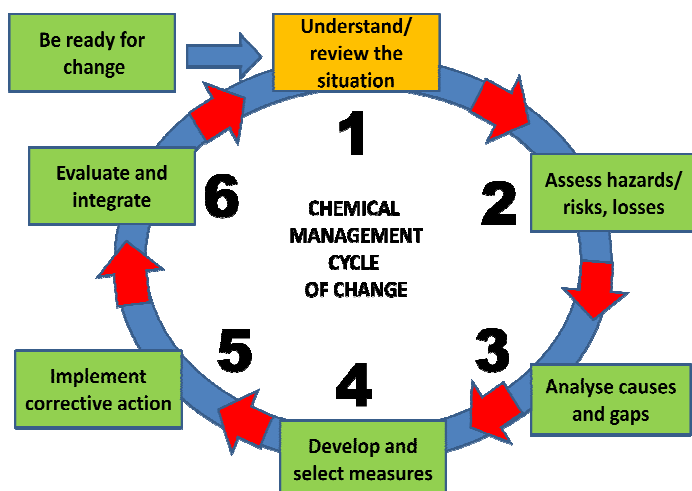
At the end of these first steps your company will have

✓	a documentation of processes and material flows in your factory, indicating various non-product outputs (as possible starting points for improvement)
✓	a comprehensive inventory of the chemicals used and present in your company
✓	a ready overview over the chemicals, categorised and classified by their hazards and severity of hazards
✓	a list of areas for immediate improvement

These results will form the first elements of your chemical management system, on the basis of which you can plan, implement and monitor specific improvements in your company.

Having a good and comprehensive idea of the chemical substances, knowing their characteristics, properties and hazards as well as understanding their flow in your company will allow you to assess the whole operating process and decide which improvement measures will help you to gain savings through the appropriate use of chemicals and reduce risks throughout your operation.

A comprehensive inventory and a detailed flow chart of the process are very important preliminary steps for doing chemical management



PRACTICAL TIP

▶ Often the information about chemicals present and in use in your company and data required to complete these steps may be scattered in small pieces around your company. The person or department in charge of purchase may have certain information on the records, your laboratory staff will have other data stored, your production manager will know something about the chemicals in use, the person/department in charge of environmental, health and safety issues may need different information about the same chemicals, only the accountant can give you the latest data on consumption and costs. In the course of setting up a chemical management system you will realise that all these scattered pieces of information will be important and helpful. Contact these persons or try involving them into the process from the very beginning

What can you do with the chemical inventory?

Once you have established the chemical inventory in your company, you can

(1) Improve the management of chemical stocks in your company.

Experience from the industry shows that good and efficient management of stocks is a major source of **cost savings**. Keeping stocks often requires space and binds working capital. The chemical inventory will allow you to

- Easily keep the inventory of chemicals in your company up-to-date
- Identify near-expiry or expired chemicals and reduce losses due to the expiry of stored substances (over-stock) or of poor quality products because of using expired input chemicals
- Identify redundant products (i.e. different chemicals being used for the same purpose); less material is wasted / lost by having fewer containers in use (open) at the same time

- Identify unknown substances, which only take up storage space and dispose of them properly.

(2) Enhance the general awareness and knowledge about the chemicals in your company

During the implementation of these steps in this module you will collect and systematically document further data on the chemicals used in your company in the chemical inventory. The chemical inventory will allow you to

- Clearly identify hazardous and non-hazardous chemicals
- Update the hazard and risk database on chemicals
- Better differentiate between the types of hazards e.g. physical (flammability, explosivity), health (carcinogenicity, toxic to reproduction) and environmental (bio accumulative, persistency, eco toxicity) of the chemicals, using different in-house and external sources of information. This in turn will help you to gain a better understanding of what may be required to minimise the exposure to hazardous chemicals in the workplace, or reduce the risk and losses from inadequate storage, their impact on the environment as well as to take steps towards preparing for a proper response to possible emergencies involving these chemicals.
- Use a simple and standardised procedure for assessing the hazard and risks of chemicals and identify priority areas of action such as replacing hazardous with less hazardous input chemicals

Avoid incidents and accidents due to unawareness and lack of knowledge

(3) Communicating your performance

The better knowledge base on the chemicals in use will allow you to be more aware of banned or restricted chemicals that customers in international markets will not accept, and make necessary adjustments and thus enhancing competitiveness. This will also reduce the chance of your products getting rejected because of failing to meet certain buyer requirements (which often specify chemicals that should not be used). At the same time, you can use these documents and records to easily respond to inquiries from customers or authorities with regard to the use and avoidance of banned or restricted chemicals.

Once a comprehensive chemical inventory is completed, it can be used as a benchmark for making improvements on a continual basis!

(4) Start managing your risks

Only after you have collected and documented all the relevant information in an inventory sheet or similar form this will become a powerful risk management instrument that will allow you to minimise or completely avoid your risks on-site.



Understand and review the situation in your company

Activities

1.	Conduct a material flow analysis
2.	Identify and quantify the most important Non-Product-Outputs (NPOs) in your factory, with special focus on chemicals used
3.	Document your findings in such a way to allow your colleagues and workers to participate in the process
4.	Identify the chemicals stored and in use in the different parts of your enterprise
5.	Explore which information is already available on these chemicals and what might be missing
6.	Collect missing information on chemicals

Increase resource efficiency/Analyse material flows and identify non-product outputs in your company

Understanding material flows (particularly of chemicals) in your enterprise and identifying potential non-product outputs will help you to also discover various cost saving areas in your company.

When we look at the production in our company, we usually focus on the final product. This is not surprising as it is this product we want to sell and get a good price for. At the same time, we may overlook the fact that many inputs, which we use to produce this product, do not end up in the final product and end up as waste, either in solid or liquid form, dissolved in waste water or as air emissions. By looking at the non-product outputs (NPOs), for all the inputs which do not end up in the final product, you will be able to see your production from a different perspective. Most NPOs are indeed waste and emissions, which will negatively affect your company's profits. The identification of NPOs will help you to set priorities for which problems to solve first. The systematic approach of doing so will allow you to compile existing data while at the same time bringing the necessities to

your attention. For these steps, this toolkit will show possible ways of doing and how to document your findings, so others in the company can benefit from this information and can get involved. This step may involve discussions with representatives from different production areas, visits to the site and reviews of existing documents.



Figure 1 – Simplified flow of inputs and products in an enterprise

To identify these potentials for saving and improvement you can start by drawing a flow diagram of the production in your company, which will help you to understand where the main processes and material streams occur and where you can look for NPOs. The flow diagram shows the inputs e.g. raw materials, auxiliary materials (e.g. chemicals), water, energy and other inputs as well as the intermediate products and non-product outputs (NPOs) of at least the main production process (see flow diagram sample in figure 2).

When preparing the flow diagram, do not forget to indicate storage and transfer activities in the diagram as well. You can still further refine the streams later on, for example by breaking down raw materials into further categories such as more specific raw materials, chemical groups or individual substances, auxiliary material, etc.

PRACTICAL TIP

► It is always beneficial to involve other people in your company in preparing or reviewing the flow diagram, bringing together a wide scope of experience and knowledge or verifying the same with a site visit

To check whether your flow chart contains all relevant information, ask yourself the following questions:

- Can/Do you recognise the sources of your non-product outputs?
- Have all important inputs in each production process been considered?
- Have all intermediary products been identified?
- Have you been able to quantify inputs and outputs?
- Can you clearly assign costs to the different NPOs?
- Are there any information gaps, for which you may need to collect further information?

There are several different methods and ways of preparing such a flow diagram. Whatever method you finally decide to use, make sure that you are able to identify a large variety of NPOs.

Typically, you will find NPOs with regard to electricity, heat/steam, process water, raw materials and chemicals inputs. For the purpose of chemical management we will focus on the chemical inputs and non-product outputs only.

Identify areas which may need immediate attention (“hot spots”)

Some owners/managers of companies that have given little attention to chemical management have told us that they need to see the short-term benefits of such efforts before they would be convinced of the merits to invest time and effort in establishing chemical management. For such reasons, the identification of “hot spots” can be a practical first step for improving the handling of chemicals in your operation. This can easily be combined with the activities described in steps 1 or 2.

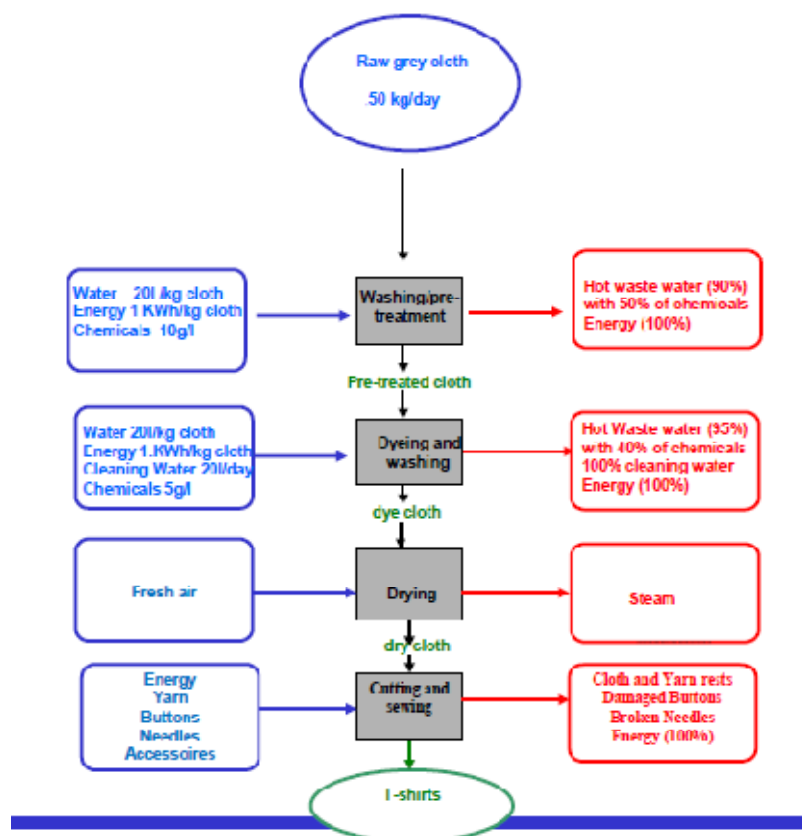


Figure 2 - Sample flow diagram of a T-shirt production process. NPOs are in red, inputs in blue and products in green

“Hot spots” are areas where you may observe

(1) Obvious economic losses due to inefficient storage, handling, use and/or disposal of chemicals and where immediate improved practices could lead to cost saving and/or

(2) Immediate risks for workers’ health and safety and/or the environment linked to the handling of chemicals and where potential harm to the workers and/or environment can be reduced.

Look specifically at how chemicals are being treated in the production flow, involving purchase, storage, handling and processing with the aim of spotting inefficiencies, wastage, losses and risks. Identifying such “hot spots” will not only allow you to initiate first improvements but will also help you to sensitise your colleagues and/or workers to chemical management. This will set the path towards a more systematic approach for chemical management, which leads to a change in company culture and helps to move towards a process of continual improvement, not only in the area of chemicals.

PRACTICAL TIP

▶	<p>For the walk-through for identifying hot spots,</p> <ul style="list-style-type: none"> • Team up with colleagues and co-workers and conduct the walk-through as a team – two pairs of eyes see more than one • Do not only rely on your own observations but involve workers and clarify the situation on-site
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Identifying and dealing with “hot spots”

1.	<p>Prepare or take an existing ground plan of your company, showing the internal layout as well as parts of the close outside area. Mark the section, departments, processes where chemical substances are stored and/or used. It helps to go to the different areas and verify the information on the spot, involving the staff at site. <u>Important:</u> Do not forget in-house disposal areas, waste yards or areas for waste water containing chemicals!</p>	<p>Example of ground plan in figure 3</p>
2.	<p>With your drawn ground plan, conduct a walk-through of your entire operation, following the flow of chemicals through the different steps of purchasing, delivery, storage, handling, processing and disposal</p>	
3.	<p>Write down you observations on a separate worksheet noting all situations where you see “hot spots”. Also mark these in you ground plan</p>	<p>Sample worksheet Reference list – Walk-through HO No 4n</p>
4.	<p>Review your findings & initiate corrective action (see sample action plan). Don’t forget to monitor & follow-up</p>	<p>Sample Action Plan see fig 4</p>

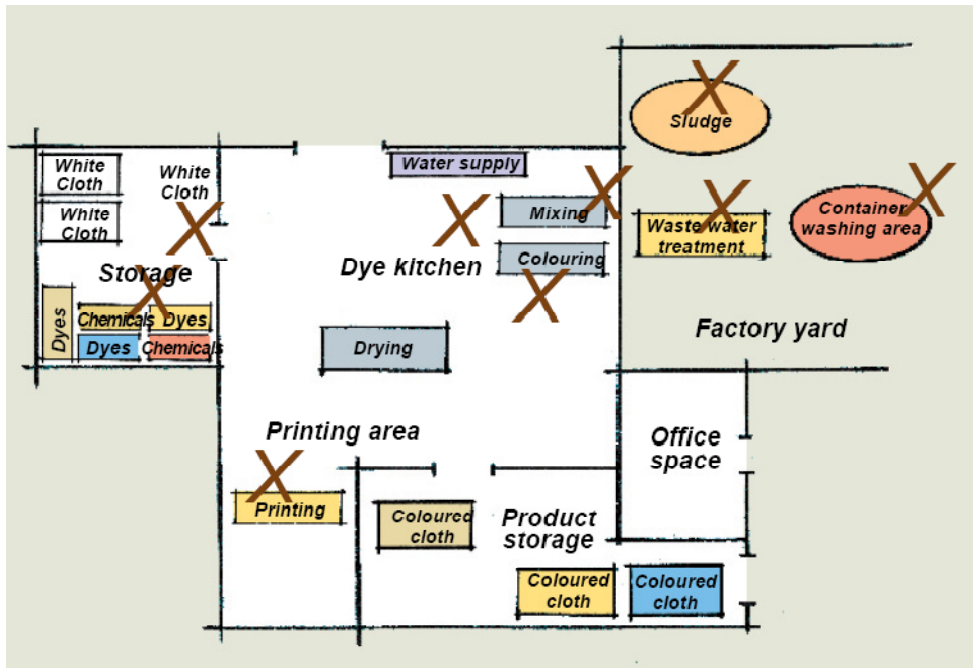


Figure 3 - Sample ground plant of a textile manufacturing company

You can use your ground plan to add additional information or details (e.g. marking hot spots with an X) – also think about preparing additional plans only showing specific parts, sections or processes in your company.

PLAN, FOLLOW-UP AND CONTROL CORRECTIVE ACTION

Department/Section	STORAGE	Sheet	1	of	1
Area/Place of work:	Powdered chemical store	Period (year, month, day)	2010-09-15		

No.	Hot spot/ Observation	Proposed measure	Responsible person	To be completed by date	Results Achieved	Remarks
1	Chemicals spoiled by rain water	Repair leaking roof part near entrance door Check for leaks in other areas and repair	Store-in-charge Store-in-charge	Sep 30 Oct 15		
2	Bag with powder chemicals stored next to light switch	Move bags to pallets in X area	Store-in-charge	Sep 30		
3	Torn bags in delivery area	Advise workers to check and report any torn bags on delivery	Purchase-in-charge	Immediate	✓	Called supplier to inform about torn bags; requested to pay special attention to quality of bags
4					

Figure 4 – sample of an action plan for hot spots

Identify and document all chemical substances stored and in use in your enterprise

You can already start this step parallel to the previous activities. While gathering information about the material flows, NPOs and “hot spots” you can collect information on different chemicals used or present in the different parts or production steps of your company. The systematic identification of all chemicals will allow you to establish a standard inventory, based on which you will be able to carry out a risk assessment of each chemical present in the company and rank the chemicals according to their hazard potential. Having compiled all the information required in these steps, you can then manage losses and risks, thus improving your company’s performance.

To create a chemical inventory, first investigate what information already exists within your company regarding chemicals present and used, for example purchase orders and records, stock control cards, production plans. This documentation provides a good starting point. Also take a look at the flow diagram and ground plan to compare or complement the information on the chemicals in your company.

PRACTICAL TIP

▶	<p>Be aware that chemicals can be:</p> <ul style="list-style-type: none">• Individual substances or mixtures (formulations), which can be released as vapours during the handling of formulations or products• Generated during work activities (e.g. dust, fumes from welding) or as result of chemical reactions• Used as auxiliaries (e.g. fats, liquors, dyes, paints, adhesives)• Used for other purposes than production, such as for cleaning workplaces and maintaining machinery (e.g. detergents, disinfectants, solvents, oils, greases)• Found in final products (e.g. leather, textiles, panels, bricks, etc.)
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Review the different sources of information on the chemicals in your company (e.g. purchase orders, production lists) and start preparing a chemical substances list, adding those you have found during the walk-through. There is no specific format for how to prepare the list, but we suggest that you use the sample format as shown in figure 8. This format of an inventory list will allow you to compile the information and data which you collect during the next steps into one single list.

At this point you will already be able to indicate the name of the chemicals as stated on its container or packaging (or as referred to in your company) as well as the place where chemicals and their waste can be found in your company (e.g. process, department, and store).

As a good practice, every chemical substance should be clearly and easily identifiable, for example by clearly understandable labels on the container or packaging. This also applies for containers which are used for temporary storage, such as for mixing or in-house transport.

PRACTICAL TIP

▶	<p>You may come across chemical substances that you cannot identify immediately. Assign a temporary name (e.g. Unknown 1, Unknown 2) to these substances in your inventory table. Write this temporarily assigned name on a tag, and attach the tag to the chemical container in the factory to allow for follow-up at a later stage. Be sure to specify in the map the physical location of these substances within the factory. Quite often somebody in your company may know the “unknown” chemical. If not, you may have to analyse the chemical, so as to find out how the chemical needs to be disposed of, if it is not of further use to your company</p>
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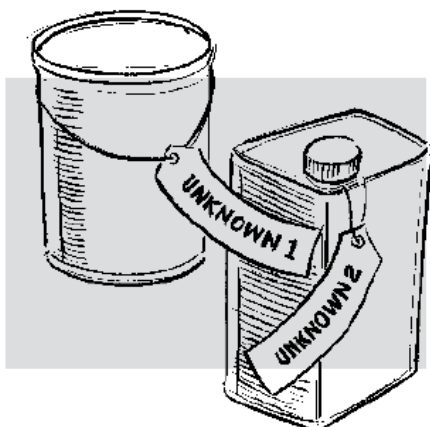


Figure 5: Label also unknown chemicals in your company during your inventory activities (Source ILO)

Identify and assess the health hazards and risks of the different chemicals in use

Activities

1.	Categorise the chemicals identified by type of their hazard(s)
2.	Collect and analyse information on how the chemicals are used in your enterprise
3.	Assess the hazards and risks
4.	Consolidate your chemical inventory
5.	Determine the recommended control approach
6.	Segregate hazardous from non hazardous waste

At this point, you have already completed a substantive part in the preparation of the chemical inventory. You know which chemicals are present in your company and where these can be found. You may also have identified first points for improvement already such as in terms of ensuring systematic labelling of chemical containers or clarifying on unknown chemicals.

Categorise your chemicals by type of their hazard

Not all of the chemical substances which you have identified have to be hazardous. Hazardous chemicals are defined as chemicals which have an inherent property to cause harm either to humans or the environment and/or cause damage through fire, explosion or through corrosivity or toxicity. These usually require special procedures for safe handling.

As the data on hazard/safety of the chemical represents key information for proceeding with the assessment and management of chemical risks, do not proceed unless you have obtained and documented this information. Getting such reliable information may sometimes be very tricky, but there are several sources of information.

Use different sources of information on chemical hazards

1. Labels, markings, pictograms or other indications on the chemical containers

As per international practice and recommendation, chemical containers and packaging should allow for clear identification of chemical substances. The manufacturer should also indicate whether the substance you use may be hazardous and may pose a risk, if exposed to humans or the environment or accidentally released. For these purpose different internationally standardised labels, markings, symbols, risk-phrases or hazard statements are commonly used by chemical manufacturers and suppliers.

To read more about common



[Symbols used in labelling hazardous substances in the EU](#)

and about GHS pictograms read:



[Pictograms used according to GHS](#)

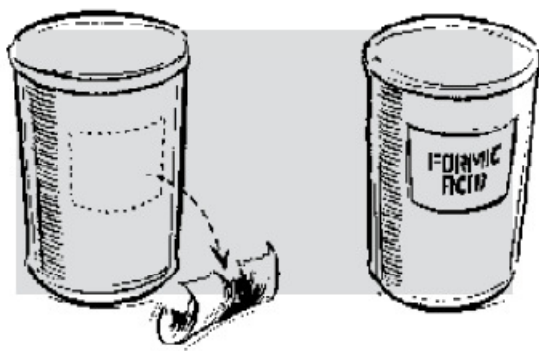


Figure 6: No chemical container or packaging in your company should be without a label

Remember

Ensure proper labelling of chemicals that are stored and used in your operation is a critical aspect for achieving optimal use and determining the steps to be taken in case of accident or emergency

In addition to symbols and pictograms, markings and labels may also contain various abbreviations such as risk or safety phrases. Risk Phrases (R-Phrases) refer to a system of standardised abbreviations and number coding for describing risks associated with chemicals; safety phrases (S-Phrases) are similarly structured but describe recommended safety measures. The system of R- and S-phrases has been developed and implemented in the European Union.

In the European Union the R- and S-phrases will gradually (until 2015) be replaced by hazard (H) and precautionary (P) statements in line with the Globally Harmonised System (GHS) for classification and labelling of chemicals.

See figure 7a below for an example of an EU / EC label and figure 7b for one of an EU-GHS label.

EU/EC label

Example of Methanol

The image shows an EU/EC label for Methanol. It features a large 'M' logo in the background. On the left, there is a table of technical specifications. In the center, the product name 'Methanol' is written in multiple languages (German, French, English, Spanish, Italian, Portuguese, Dutch, Greek, Czech, Slovak, Hungarian, Polish, Slovenian, Croatian, Serbian, Bosnian, Macedonian, Bulgarian, Romanian, Czech, Slovak, Hungarian, Polish, Slovenian, Croatian, Serbian, Bosnian, Macedonian, Bulgarian, Romanian). Below the name, there are hazard symbols: a flame (Highly flammable) and a skull and crossbones (Toxic). To the right of the label, there are callouts: 'Symbols' pointing to the hazard symbols, 'R/S phrases' pointing to the hazard and precautionary statements, and 'Indication of danger' pointing to the orange background of the hazard symbols.

Figure 7a EU label

EU-GHS label

Example of Methanol

The image shows an EU-GHS label for Methanol. It features a large 'M' logo in the background. On the left, there is a table of technical specifications. In the center, the product name 'Methanol' is written in multiple languages. Below the name, there are hazard pictograms: a flame (Highly flammable), a skull and crossbones (Toxic), and a gas cylinder (Highly flammable gas under pressure). To the right of the label, there are callouts: 'Pictograms' pointing to the hazard pictograms, 'Signal word' pointing to the word 'Danger', and 'Hazard/precautionary statements' pointing to the text describing the hazards and precautions.

Figure 7b GHS label

To learn more about codes of R-Phrase, go to



[Overview of R- and S- Phrases](#)

To read more about H statements go to



[GHS hazard and precautionary statements](#)

2. Safety data sheets

A chemical safety data sheet (SDS), formerly also known as material safety data sheets (MSDS), is a document which lists the properties of a particular chemical substance or mixture. These sheets are a widely used system for cataloguing information on chemicals, chemical compounds, and chemical mixtures and provide information such as

potential hazards associated with a particular material or product and instructions for the safe use.

The safety data sheets are a ready reference and guideline for you, your workers and emergency personnel on how to handle or work with that substance in a safe manner. These also include information on physical data (melting point, boiling point, vapour pressure, flash point, etc.), physical state (liquid, powder, pellet, gas) toxicity, health effects, first aid, reactivity, recommendations for storage and disposal, protective equipment to be used with this specific chemical, and spill-handling procedures in case of accidents.

The formats of these sheets can vary from source to source within a country depending on national requirements. As in the case of labels and markings, there is a move towards standardising the different chemical safety data sheets (SDS) in line with the Globally Harmonised System (GHS) for classification and labelling of chemicals.

In many countries, e.g. EU, USA, chemical manufacturers or suppliers are required by law to provide safety data sheets for chemicals along with the chemicals. Ask your chemical supplier to always include this information when delivering the chemical to you or to provide you with the latest version of the safety data sheet.

To learn more about structure and content of a safety data sheet, go to:



[Overview of Safety Data Sheet content and structure and how to use the information](#)

3. Useful internet resources

In addition, you find useful information on chemicals on the internet. For example, check with sites such as

• SRI MSDS Index	www.hazard.com/msds/index.php
• MSDS Solution Centres	www.msds.com/
• NIOSH/ WHO	www.cdc.gov/niosh/ipcs/ics/tart.html

(multilingual safety cards)	
• Internet Resources for MSDS	www.ilpi.com/msds/

Or check the websites of your chemical supplier or respective chemical manufacturer.

Read more about:



[International Chemical Safety Cards \(ICSC\)](#)



[Pesticide Data Sheets \(PDS\)](#)



[Oral and written instructions](#)

Remember

In case you do not have information for each chemical in the form of a safety data sheet (SDS) or need further information, contact your chemical supplier

PRACTICAL TIP

▶ Make sure that all chemical containers are checked for proper labelling/ marking at the time of delivery or purchase. Include this as a specific requirement into your purchase orders

Training of workers for understanding labels, handling chemicals safely and (what procedure to do) if something goes wrong, is a crucial prerequisite for any progress in the proper handling of chemicals

Review the information available and verify whether the specific chemical poses any physical (e.g. flammability, explosivity), chemical (corro-

siveness, reactivity), environmental and/or health/safety hazards.

If so, enter the information into your inventory table. In the sample inventory table, see figure 8, you can either just tick the respective hazard (see column 6), and/or include an abbreviation (R-

phrase or H-statement code) or longer description of the hazard itself (in column 5).

Quick guide to the sample inventory and control approach table as shown in fig 8

Column 1	Area/process	Indicates the location or part of your company where this chemical is used or stored. If the same chemical is used in several different places, add additional lines.
Column 2	Name	Enter the name of the chemical as it is known and used in your company. If you use a colloquial name, make sure that you use an additional reference which allows for outsiders to determine the chemical, for example a CAS Number (The Chemical Abstract Service - CAS number is a unique standardised numeric identifier, designating only one specific chemical).
Column 3	Price/Supplier	Enter the price of the chemical e.g. 25 US\$/kg and the name of the supplier
Column 4	Safety Data Sheet	If the safety data sheet is available in your company, indicate this in this field e.g. by “yes” or a tick mark. This allows you to verify whether the safety documentation for your chemicals is complete and/or where further information needs to be obtained.
Column 5	R-phrases/ hazard statements	Enter the standardised abbreviations/codes for the different hazard types, which you can find in the safety data sheet (SDS). In Annex 2 you can cross-check the meanings of each R-phrase’s code.
Column 6	Hazard type	You can use these columns for a general overview of hazards associated with the chemical.
Column 7	Hazard group (inhalation)	Using annex 4a, you can identify the hazard level of chemicals which you may be exposed to by inhalation. Once you have identified the hazard group, enter the letter code here. Looking at this column, you will be able to immediately recognise the most hazardous chemicals in your company.
Column 8	Hazard group (skin)	Using information in annex 5a, you can identify the hazard level of chemicals which you may be exposed to by skin contact. Once you have identified the hazard group, enter the letter code here. Looking at this column, you will be able to immediately recognise the most hazardous chemicals in your company.
Column 9	Amount per batch/task	Verify whether your company operates in batches or continuous processes and check the usual amount of the chemical used per batch or day. If the quantities used vary on a day-by-day basis, take the largest quantity used in the course of a year.

Column 10	Dustiness/volatility	This characteristic of the chemical will allow you to determine how likely the substance is to be released into the ambient air of the workplace. High dustiness (for solid chemicals) and volatility (for liquid chemicals) implies higher probability of exposure to this substance.
Column 11	Quantity on skin	It is important to differentiate between splashes on skin or immersion of skin
Column 12	Duration of exposure on skin	It is important to differentiate below or over 15 minutes exposure per day
Column 13	Control approach or control method	Once you have completed the risk assessment process, you will be able to determine what kind of control method will be appropriate to contain the risk of the specific substance.

1	2	3	4	5	6			7	8	9	10	11	12	13	
					Hazard type*									Control approach	
Area/ Process	Name	Price/ Supplier	SDS Yes/ No	R-phrases/ Hazard statements	P	H	E	Hazard group Inhala- tion	Hazard group skin	Amount per batch/task	Dustiness/ volatility	Quantity on skin	Duration of expo- sure on skin	Inhala- tion	Skin
Dye kitchen	Acetic Acid		Yes	R 10, R35				C	E	8 l Medium	Liquid Medium				
Dye kitchen	C.1 Basic Yellow		Yes	R22, R41, R50/53				B	-	7 kg Medium	Liquid Medium				
Dye kitchen	C.1 Reac- tive Black 5		Yes	R42/43				C	C	3kg Medium	Solid Medium				
Printing	2- Naph- thol		Yes	R20/22 R50				B	-	85 kg Medium	Solid Low				
Printing	Sodium Hydrox- ide		Yes	R35				C	E	10 kg Medium	Solid Low				
Storage	Aniline		Yes	R20/21/22 R40, R48/23/24/2 5 R50				D	D	10 l Remaining stock	Liquid Low				
Yard	Citric Acid		Yes	R36/37/38				A	-	Medium 250 g	Solid Medium				
Printing	Un- known 1														
Storage	Un- known 2														

Figure 8 - Example of an inventory control table in a textile company (* P= physical, including flammability and explosivity, H= health, E= environment hazards)

Assess hazards and risks of chemicals in your company

At this point you will have categorised the chemicals as being hazardous and non-hazardous as well as having an overview over the prevalent types of hazard(s). Depending on the size of your company and the number of chemicals in use, this process will take about two to three weeks to complete.

As a next step you look at the different overall categories of hazards and get further information on how these chemicals may affect you or the environment. For example, in case of their potential effects on your health, you have to look at whether and how you are getting exposed to the chemical substances.

Understand chemical exposure and toxic effects of chemicals

Chemical Exposure' is any work situation in which a chemical agent is present and a person comes into contact with this agent. Hazardous substances may enter the body through the lungs (inhalation), the skin (absorption) and / or the mouth or stomach (ingestion). Most commonly, we are exposed to chemicals through skin contact and inhalation.

Different substances can cause harm in different ways. Some chemicals are more hazardous and can cause more harm than others (for example weak and strong acids). Exposure to some substances may result only in minor irritation of the skin, while others cause severe burns, greatly damage the respiratory system or even result in death. Some effects on your health appear immediately (e.g. acute toxicity: cyanide poisoning) while others may only become apparent after several years (e.g. chronic toxicity: lung cancer caused by asbestos).

Whether chemicals pose a higher risk than others mainly depends on a combination of factors such as (1) how hazardous the chemical itself is, (2) what quantity is used or may be released, and (3) in which way or under which conditions the chemical is used or handled as well as how often and how long we might be exposed to the chemical.

In many situations, we may be exposed to two or more chemicals at the same time. The combined effect of this multiple chemical exposure may result in a graver effect on our body, for

example due to a reaction of these chemicals in our body.

Typical categories of how chemicals affect our body	
Causing irritation	Usually affecting skin (e.g. dermatitis), eyes and respiratory tract (nose, throat, airways, inner lung, with symptoms such as coughing, shortness of breath, oedema)
Allergies	Usually affecting skin (pimple) and respiratory tract (urge to cough)
Lack of oxygen (asphyxiation)	Interference with oxygenation of body due to low level of oxygen in breathing air or direct effect of chemical on body's ability to transport oxygen
Systemic poisoning	Adverse responses induced by chemicals (e.g. liver injury, interference with functioning of kidney, impairment of the nervous system, sterility, miscarriages)
Cancer	Usually long-term exposure causes uncontrolled growth of cells, resulting in cancerous tumours
Damage to unborn foetus	Interference with development of the normal foetus due to chemical exposure
Toxic for reproduction	Change in the genetic material due to exposure to chemicals
Dusty lung	Deposits of small dust particles in the inner lung gradually reducing the capability of the lungs to absorb oxygen, leading to shortness of breath and more severe impairments of lung function

Source: ILO Safety and Health in the Use of Chemicals at Work

Assess the health hazards and risks

Using the proper information on potential risks will help you to diminish risk situations. If you assess your risks, then you can control and manage these better.

You do not need to be a chemist to get all the right information you need for risk assessment. Your inventory table and the control banding methodology will support you. To identify which chemicals or situations you may have to look into as a priority basis, you can rank the chemicals according to their potential for causing harm.

Control banding methodology

In order to determine the potential of chemicals to cause health harm by inhalation and skin contact, you can use the following three chemical risk assessment tools

- COSHH¹ ESSENTIALS, developed by the Health and Safety Executive (HSE) in the UK
- ILO International Toolkit²
- EMKG³ developed by the German Federal Institute for Occupational Safety and Health (BAuA).

In these tools, chemical substances are categorised in different hazard groups (A-E), depending on their potential for causing health harm as a first step to determine the appropriate control approach.

Hazard groups	Risk (R-) Phrases
A	R36, R37, R65, R67 and all dusts and vapours not allocated to another band
B	R20, R20/21, R22, R20/22, R41, R68/20, R68/22
C	R23, R23/24, R25, R29, R31, R34, R35, R39/23, R39/25, R40, R42, R48/20, R48/22, R62, R63, R68
D	R26, R28, R32, R39/26, R39/28, R48/23, R48/25, R61
Special cases	E R45, R46, R49, R60

Table 1 - Classification of Inhalation Hazard Groups A to E for chemicals causing harm when inhaled based on their links to certain R-Phrases as modified by BAuA, 2009

¹ Control of Substances Hazardous to Health Regulations see details at:

<http://www.hse.gov.uk/coshh/essentials/index.htm>. The ILO Safe work Chemical control Toolkit and EMKG are based both on COSHH essentials

² http://www.ilo.org/legacy/english/protection/safework/ctrl_banding/toolkit/icct/index.htm

³ Easy to use workplace control scheme for hazardous substances (Einfaches Massnahmen Konzept Gefahrentoffe) see details at:

<http://www.baua.de/de/Themen-von-A-Z/Gefahrstoffe/EMKG/EMKG.html>

Inhalation hazards and risks

- You can categorize the chemicals by their R-Phrases or corresponding H-Statements into **five hazard groups (inhalation)**. The potential of causing harm when inhaled is described with a letter from A to E. In this table A stands for the least hazardous and E for the most hazardous chemicals:



[You can also determine these five inhalation hazard groups](#)

using H-statement codes or occupational exposure limits (OELs)

Skin hazards and risks

- In a similar way you can categorise chemicals into **five hazard groups (skin)** as per their potential hazard of causing harm, if in contact or absorbed by the skin, again referring to the chemical's R-phrases or H-statement.

Once you have determined the hazard group of the chemicals for exposure by inhalation and skin contact, you can enter the letters of the hazard groups into the respective columns of your inventory table (see fig.8).

By simply looking at these columns you will quickly be able to decide which chemicals you may need to pay specific attention to:

In a ranking of letters from A to E, the last is considered the higher. The higher the letter of the hazard group, the more hazardous the chemical and the higher the priority to manage the risk

Depending on the level of potential harm (high to low) of these inhalation and skin hazardous chemicals, different approaches to control will have to be chosen. Chemicals that have the potential to cause more serious harm to human health require a greater level of control than less harmful substances.

Skin Hazard groups	Risk (R-) Phrases
Skin A	R66
Skin B	R38
Skin C	R21, R21/22, R43, R42/43, R48/21, R68/21,
Skin D	R24, R23/24, R23/24/25, R24/25, R34, R40, R39/24, R48/24, R62, R63, R68
Skin E	R24 and R34, R27, R35, R39/27, R45, R46, R60, R61

Table 2 - Classification of Skin Hazard Groups A to E for chemicals causing harm when absorbed is based on their links to certain R-Phrases, BAuA 2009



[You can determine the five skin hazard groups using H statements also](#)

Find out how the chemical is used

So far you have determined the hazard of the chemical, i.e. its intrinsic potential to cause harm. This also applies if this chemical becomes waste. The probability (or risk) of the chemical to cause harm to your health depends on whether you are exposed to it or not. Without exposure to the hazardous chemical there is no risk to your health.

To determine if a significant risk exists in your operation through the actual use or handling, you need to look at two factors:

Factor 1	What quantity is used and/or handled?
Factor 2	What is the chance that a person may get exposed to the chemical, either by inhalation or skin contact?

Factor 1: What amount of the substance is being used?

In line with the HSE, ILO and BAUA tools, first you need to decide if the amount of the chemical that is used in each batch (or daily for continuous operations) is in solid or liquid form. Secondly you decide whether the amount in use over a period of time can be described as small, medium or large.

Figure 9 can help you determine this based on the weight/volume of the substance and the form in which it is delivered or handled.

The quantities in use may differ in the different processes and within a production step. For example:

- A worker may transport a full bag or drum of chemicals from the store to the production area. Then the same or another worker uses a small measuring cup to weigh or prepare the chemical for dosing. Thereafter, the chemical is being added to the process, for example through a pump and pipe, or by pouring the chemical using a cup.

In such a situation you will need to assess the risk for the different situations or steps of handling the chemical separately

PRACTICAL TIP

▶ Depending on the production set-up and the product you make, you may not use the same quantity all the time. The amount may vary quite significantly. In this case take a conservative approach and use the largest amount used at a time (batch) as your reference for the assessment

Decide if the amount of chemical you use per operation or batch can be described as:

Small – grams or millilitres

Medium – kilograms or litres

Large – tonnes or cubic metres



Figure 9 - Determining the amounts of chemicals required for the production process

If you are in doubt about the amount, choose the larger quantity

Factor 2: What is the chance of a person getting exposed to the chemical, either by inhalation or skin contact?

This question will be answered separately for chemicals depending on whether you are exposed to it by inhalation or skin contact.

Exposure by inhalation or skin contact?

▶	Inhalation	Go to Section 1.
▶	Skin contact	Go to Section 2
▶	Inhalation and skin contact	Work through section 1 and 2 in sequence

Solid or liquid chemical?

▶	Is the chemical a solid one?	Go to Subsection 1.1
▶	Is the chemical a liquid one?	Go to Subsection 1.2

Section 1: Chemicals exposed to through inhalation

The physical form of a substance influences how likely it is to become airborne and reach your breathing zone. In this respect, you need to consider the level of dustiness for solid chemicals, and the level of volatility for liquid ones. As a rule of thumb, the more volatile or dusty the chemical is, the more likely it is that the chemical reach your breathing zone where you may inhale it.

1. 1. Determining the dustiness of substances

Choose the description which characterizes the state of the chemical best. You can also find this information in the respective SDS (section 9)

Dustiness	Appearance
LOW	Pellet-like solids that do not break up. Little dust is noticed during use (e.g. PVC pellets, waxed flakes)
MEDIUM	Crystalline. Granular solids Dust settles quickly (e.g. detergents)
HIGH	Fine, light powders When used, dust clouds form and remain in the air for several minutes (e.g. cement dust, carbon black, chalk dust)

1. 2. Determining the volatility of substances

Volatility refers to the ability of a liquid to turn in to a vapor and therefore get into the air. To determine the volatility of a liquid, you need to find its boiling point, which refer to the temperature at which a chemical substance gives of vapors. You should find this information in the respective safety data sheet. Alternatively you can contact your supplier. Compare if the boiling is low (above 150°C), medium or high.

Volatility	Boiling point
LOW	Boiling point above 150°C
MEDIUM	Boiling point between 50°C and 150°C
HIGH	Boiling point below 50°C

For certain liquids instead of boiling point, vapor pressure has to be considered. In the following box you can determine the range of volatility through vapor pressure:

Volatility range	Level of vapor pressure
LOW	Under 0,5kPa
MEDIUM	0,5 – 25 kPa
HIGH	Over 25 kPa

With the increase of the temperature in the area or process where the chemical is handled, the volatility of the chemical will increase as well. Use figure 10 to determine the volatility considering the boiling point of the substance and the operating temperature.

First find the boiling point on the left side; then move to the right until you intersect the boiling point temperature with the respective operating temperature.

PRACTICAL TIP

▶	If you are using a preparation made of two or more substances with different boiling points, use the lowest boiling point to determine the level of volatility
---	--

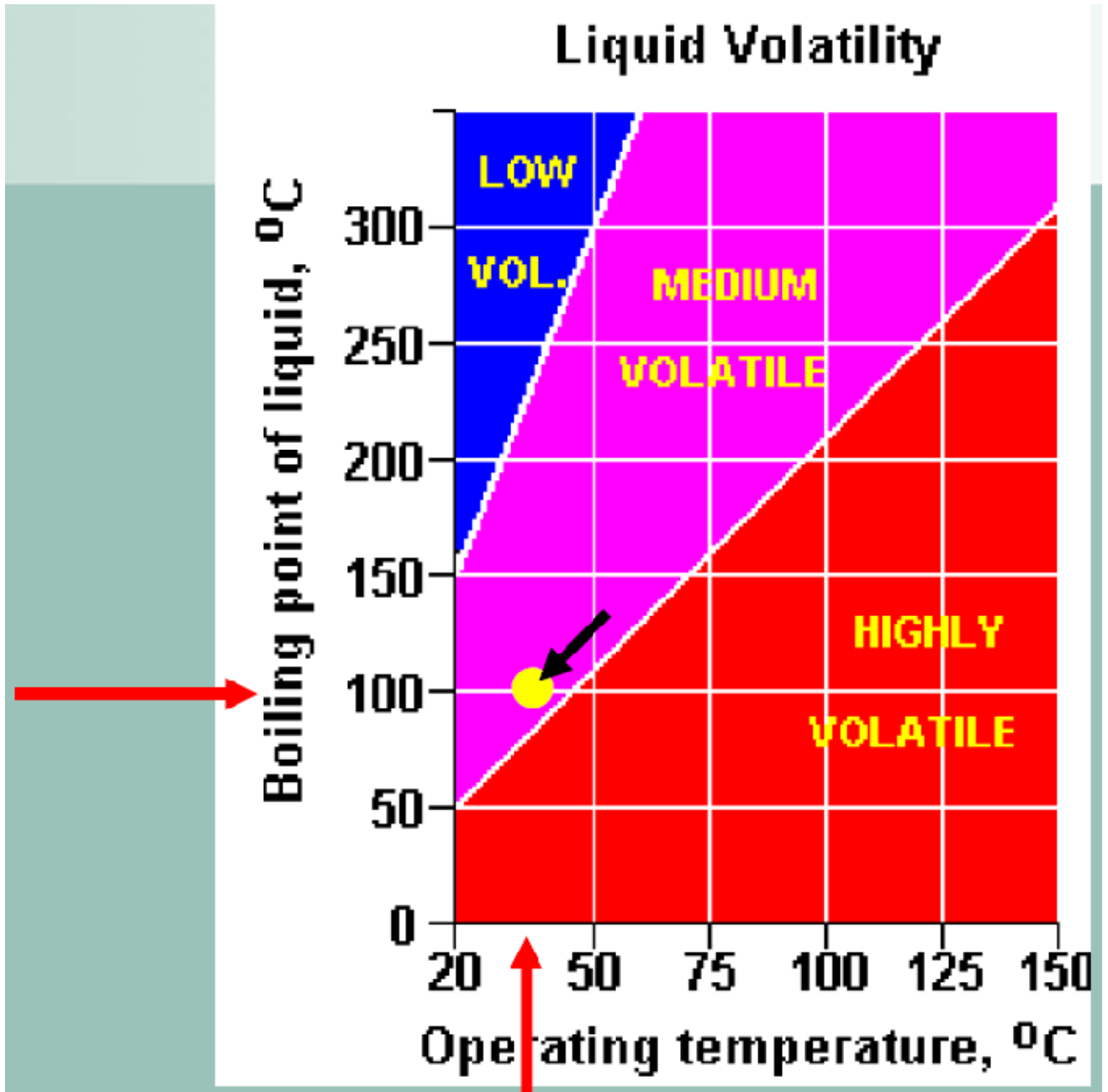


Figure 10 – Determining the volatility under different operating temperatures and 1 atmosphere

Section 2: Chemical exposed to by skin contact

Commonly we may get exposed to chemicals via skin contact, while

- immersing hand, arms, body parts into liquids or solids
- being splashed on
- standing in liquids without protective footwear or skin protection
- dust or vapors settle on the skin
- touching dirty surfaces
- touching or removing dirty clothing or gloves

Once the hands are contaminated, the contamination may spread to other parts of the body or other places as well.

To assess the chance of skin contact, you first determine the quantity of the substance on the skin and secondly the duration of the exposure. Both factors will have to be determined by observing or analyzing the situation on-site.

2. 1. Determining the quantity of a substance on the skin

Choose the description which best characterizes the exposure situation

Quantity	Appearance
SMALL	Splashes
LARGE	Immersion and/or large area wetting of hands, forearms or body

2. 2. Determining the duration of the skin contact

Choose the description which best characterizes the exposure situation

Quantity	Appearance
SHORT	Below 15 minutes per day
LONG	Over 15 minutes per day

Determining the necessary control approaches for inhalation

The previous section outlined the steps to determine (1) the hazard group, (2) scale of use and (3) possibility of exposure by inhalation or skin contact.

Once you have determined this information, you can identify the approach needed to prevent or control exposure to significant hazards that may arise during the storage, use, handling, transport and disposal of a particular chemical substance.

Use table 3 to identify the necessary control approach by matching the hazard group with the amount in use and its level of dustiness or volatility. It distinguishes between four different control approaches for inhalation exposure, indicated by the numbers 1 to 4 and by four different colors in table 3. A higher control approach number or level points towards a higher risk involved in the particular situation or process.

Amount used	Low dustiness or low volatility	Medium volatility	Medium dustiness	High dustiness or high volatility
	Hazard Group A			
grams or milliliters	1	1	1	1
kilograms or liters	1	1	1	2
tons or cubic meters	1	1	2	2
	Hazard Group B			
grams or milliliters	1	1	1	1
kilograms or liters	1	2	2	2
tons or cubic meters	1	2	3	3
	Hazard Group C			
grams or milliliters	1	2	1	2
kilograms or liters	2	3	3	3
tons or cubic meters	2	4	4	4
	Hazard Group D			
grams or milliliters	2	3	2	3
kilograms or liters	3	4	4	4
tons or cubic meters	3	4	4	4
	Hazard Group E			
	For all substances in hazard group E control approach 4 is required			

Table 3 – Determining the necessary Inhalation Control Approaches

Once you have determined the control approach number, enter the number into your inventory control sheet (as shown in fig 8). Chemicals with a high control approach number will require your priority attention

Determining the necessary control approaches for skin exposure

To select the control approach for a specific chemical you have first to determine the skin hazard group, the size of the affected area in the body and the duration of contact. (As was described in detail in section 2 here above).

Table 4 shows an example for identifying the necessary control approach for a chemical belonging to skin hazard group D by matching the hazard group(D) with the size of the affected area (small) and the duration of the chemical being in contact with the skin (short). The determined control approach is medium

Skin Hazard group	Affected area	Duration of contact	Control approach
Skin A	Small	Short	Low
	Small	Long	Low
	Large	Short	Low
	Large	Long	Medium
Skin B	Small	Short	Low
	Small	Long	Medium
	Large	Short	Medium
	Large	Long	Medium
Skin C	Small	Short	Low
	Small	Long	Medium
	Large	Short	Medium
	Large	Long	High
Skin D	Small	Short	Medium
	Small	Long	Medium
	Large	Short	Medium
	Large	Long	High
Skin E	Small	Short	High
	Small	Long	High
	Large	Short	High
	Large	Long	High

Table 4 – Determining the necessary Skin Control Approaches

Determine the risks for eyes

The following risks phrases (R36 and R41) in table 5 refer to potential eyes hazards. Here you have to evaluate the risk (irritating or serious damage) and decide on a case by case basis which controls to be taken for protecting the eyes.

R-Phrase	Wording	ILO hazard group
R36	Irritating to eyes	A
R36/37	Irritating to eyes and respiratory system	A
R36/37/38	Irritating to eyes, respiratory system and skin	A
R36/38	Irritating to eyes and skin	A
R41	Risk of serious damage to eyes	B

Table 5 Classification of eye hazard groups, ILO

In some cases safety splash goggles or face shields should be worn when carrying out operations in which there is any danger from splashing chemicals or flying particles. This holds especially for those activities involving hazardous substance with the R phrases R 36 and R 41 (consult the Safety Data Sheet). Eye showers should be available in the vicinity of the working area.

After filling all the collected information in figure 8 you have started an important aspect of chemical management in your company. You know now better the chemicals in use and can already make a first selection which ones should be controlled first.


Quick review of Module 1

You have now completed the first steps of setting up a chemical management plan in your

company. As part of this process you will have the following specific results at hand, on the basis of which you can continue with the next steps as outlined in Module 2:

<input checked="" type="checkbox"/>	a documentation of processes and material flows in your factory, indicating various non-product outputs (as possible starting points for improvement)
<input checked="" type="checkbox"/>	a list of areas for immediate improvement (“hot spots”), which you are possibly already addressing
<input checked="" type="checkbox"/>	a comprehensive inventory of the chemicals used and present in your company, categorised and classified by hazards
<input checked="" type="checkbox"/>	a ready overview over the chemicals in your company and also over which chemicals will require priority attention, because of the risk they pose to health, environment or buildings safety
<input checked="" type="checkbox"/>	A first guidance for separation of waste into non hazardous a hazardous one. The non hazardous waste can easily be recycled or sold

PRACTICAL TIP

	<p>You really need to complete the inventory table /as shown in fig 8) to profit from the next module. The inventory table also serves as your inventory risk sheet, the key instrument for risk management, on the basis of which you will continue your efforts during the next module “Managing the risks in your company - Control measures and gap analysis”.</p> <p>Share the responsibility of gathering and analyzing the requested information with your colleagues</p>
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Useful references for further improvements

CONTROL BANDING



<http://www.ioha.net/controlbanding.html>

In the late 1990s the advancements made since the 1970s in risk and control strategies were combined to result in a simple but powerful concept: The health hazard of a chemical and the exposure potential can be used to perform a generic risk assessment and determined the appropriate risk management or control strategy. A strategy to control occupational exposure that may have value when there are no relevant occupational exposure limits (OELs) is known as control banding (CB).

The conceptual basis for CB is the grouping of chemical exposures according to similar physical and chemical characteristics, intended process/handling, and anticipated exposure scenarios (amount of chemical used and how workers would be exposed). Based on these factors, appropriate control strategies (that is risk management options) are determined for each of these groupings.

CB is a qualitative strategy that groups workplace risks into control categories or bands based on combinations of hazard and exposure information. This qualitative strategy to assess and manage risk focuses resources on exposure controls and describes how strictly a risk needs to be managed.

RISK ASSESSMENT

Global Product Strategy (GPS) is Guidance on Chemical Risk Assessment published in 2011. GPS was developed by the International Council of Chemical Associations (ICCA) as part of its commitment to the UN Strategic Approach to International Chemicals Management program.



<http://www.google.de/search?hl=de&source=hp&q=http%3A%2F%2Fwww.icca-chem.org%2FICCADocs%2FICCA-Glob-al+Product+Strategy.pdf&gbv=2&oq=>

http%3A%2F%2Fwww.icca-chem.org%2FICCADocs%2FICCA-Glob-al+Product+Strategy.pdf&aq=f&aqi=&aql=&gs_sm=e&gs_upl=65151527351015315716816810155131011871153116.711310

CLEANER PRODUCTION



<http://www.unido.org/index.php?id=o862050>

UNIDO Cleaner Production Toolkit



[\(UNIDO CP Toolkit English / Spanish\)](#)

This toolkit is a complete package of reading and training materials and practical tools for training of Cleaner Production auditors and undertaking Cleaner Production assessments in companies.

Promoting Resource Efficiency in Small and Medium sized Enterprises an industrial training handbook



www.unep.fr/scp/presme/pdf/PRE-SME_handbook.pdf

“Promoting Resource Efficiency in SMEs” (PRE-SME) is an effort to upscale the results of the National Cleaner Production Centers program. This training handbook is an excellent compendium of updated tables, methods and topics of RE, 2010.





ANNEX

Read more to deepen your understanding of specific chemical management and safety topics dealt with in module 1

Overview of topics to deepen knowledge of module 1

Topic 1a	Understanding symbols used in labeling of hazardous substances in the EU
Topic 1b	Understanding pictograms used for labeling of hazardous substances according to GHS
Topic 2a	Understanding EU Risk and Safety Phrases for hazardous substances
Topic 2b	Understanding GHS Hazard and Precautionary Statement Codes for hazardous substances
Topic 3a	Using (Material) Safety Data Sheets (M)SDS
Topic 3b	Quick reference to International Safety Cards (ISC)
Topic 3c	Quick reference to Pesticide Data Sheets (PDS)
Topic 3d	Using effectively written and oral work instructions
Topic 4a	Identifying inhalation hazard groups of chemicals
Topic 5a	Identifying skin hazard groups of chemicals

Topic 1a: Symbols used for labelling hazardous substances in the EU

There are different symbols used for labeling hazardous chemicals. You and your workers should know the meaning of these symbols. The symbols can be classified in 3 groups indicating physical, health and environment hazards.

The symbols in the labels give information about the different hazards of chemicals and permit thus to recognize them easily at a glance. It is important to know the risks associated with these symbols and try to avoid e.g. physical risks due to wrong storage of incompatible chemicals.

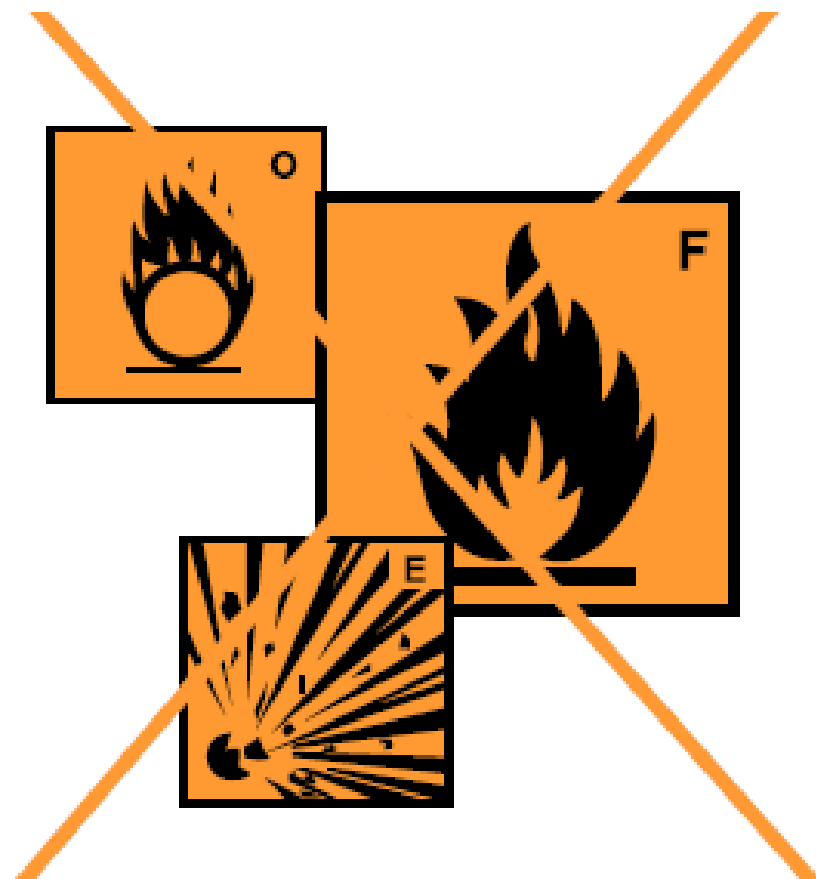


Figure 11 – Symbols of non-compatible properties of chemicals

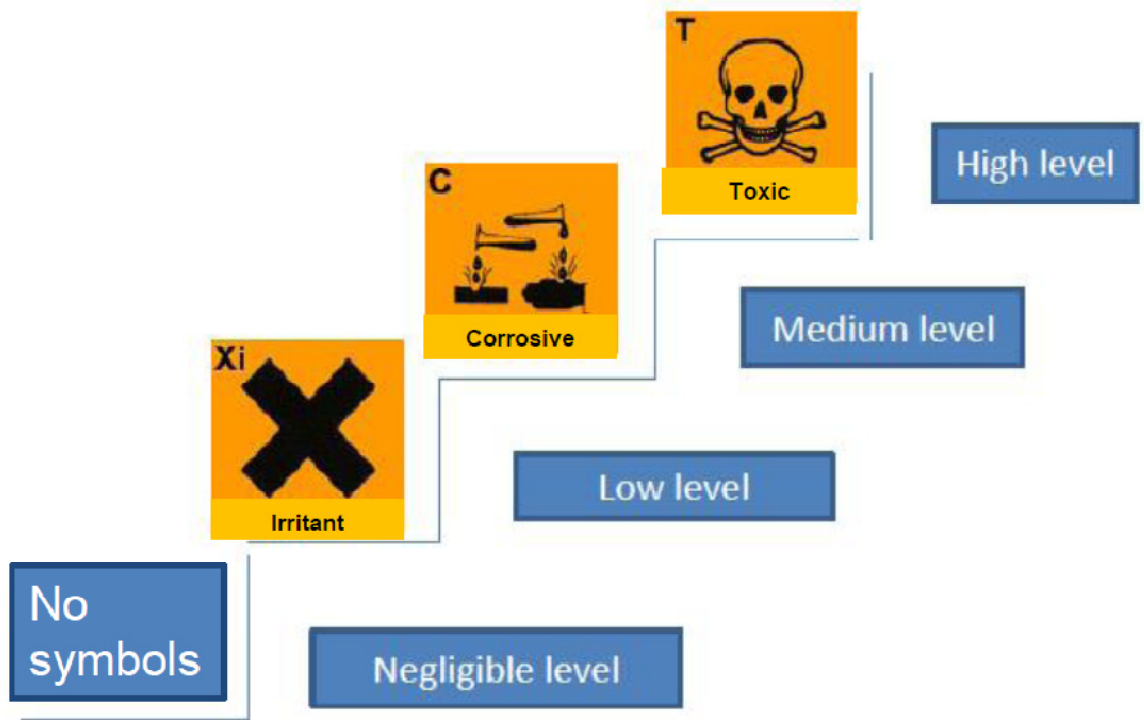


Figure 12 - Example of symbols related to health risks and different levels of protection

These symbols give also hints about the different levels of protection needed when working with hazardous chemicals. Toxic chemicals need a higher level of protection than chemicals labeled with the harmful symbol.

There is also a symbol regarding environment risks



Figure 13 – For environmental risk there is only one symbol

Classification letter symbol and Symbols used for labelling in the EU











Letter symbol	Label	Meaning
Explosive (E)	E 	This symbol with the word 'explosive' denotes a substance which may explode under the effect of a flame or if subjected to shocks or friction.
Oxidising (O)	O 	The symbol with the word 'oxidising' refers to a substance which releases a lot of heat while it reacts with other substances, particularly flammable substances.
Highly flammable (F)	F 	This symbol with the words 'highly flammable' denotes a substance which may become hot and finally catch fire in contact with air at ambient temperature or is a solid and may readily catch fire after brief contact with the source of ignition and which continues to burn/ to be consumed by chemical reaction after removal of the source of ignition. If it is gas it may burn in air at normal pressure. If it is liquid it would catch fire with slight warming and exposure to a flame. In contact with water or damp air the substance may release highly flammable gases in dangerous quantities.
Extremely flammable (F+)	F+ 	The same flammable symbol as above with words 'extremely flammable' denotes e.g. a liquid which would boil at body temperature and would catch fire if vapours are exposed to a flame.
Toxic (T)	T 	This symbol with skull and crossed bones with the word 'toxic' denotes a highly hazardous substance.
Very toxic (T+)	T+ 	This symbol as above with the word 'very toxic' is used to label a substance, which, if inhaled or ingested or if it penetrates the skin, may involve extremely serious immediate or long term health risks and even death.
Corrosive (C)	C 	The symbol with the word 'corrosive' will be found on a label of a substance which may destroy living tissues on contact with them. Severe burns may result from splashes of such substance.
Harmful (Xn) (less than T)	Xn 	The symbol with the word 'harmful' denotes to substances which may cause health hazards less than toxic. It could refer to other types of risks e.g. to allergic reactions.
Irritant (Xi) (less than C)	Xi 	The same symbol as above but with the words 'irritant'.
Dangerous for the environment (N)	N 	Can cause damage to fauna or flora or can cause pollution in natural water.

Figure 14 – Symbols and letters used in the EU

Refer to following **NAPO films** to learn more about the safe use of chemicals:



www.napofilm.net/en/napos-films/napoepisode?filmid=id_napo_film_3



www.napofilm.net/en/napos-films/napoepisode?filmid=id_napo_film_13

Topic 1b: Common pictograms used for labelling hazardous substances according to GHS

Chemicals, through the different steps from their production to their handling, transport and use, can pose a real danger to human health and the environment. People of any age, including children and elderly, coming from various social and cultural backgrounds, are confronted daily to dangerous products (chemicals, pesticides, etc.)

To face this danger, and given the extensive global trade in chemicals and the need to develop national programs to ensure their safe use, transport and disposal, it was recognized that an internationally harmonized approach to classification and labeling would provide a foundation. All countries should have consistent and appropriate information on the chemicals they import or produce. Once this is obtained, the infrastructure to control chemical exposures and protect people and the environment can be established in a comprehensive manner.

The new system, called UN ‘Globally Harmonized System of Classification and Labeling of Chemicals (GHS)’, addresses classification of chemicals by types of hazard and proposes harmonized hazard communication elements, including labels and safety data sheets (SDS). It aims at ensuring that information on physical hazards and toxicity from chemicals are available in order to enhance the protection of human health and the environment during handling, transport and use. The GHS also provides a basis for harmonization of rules and regulations on chemicals at national, regional and worldwide level. This is an important factor for trade facilitation.

The Plan of Implementation of the World Summit on Sustainable Development (WSSD), adopted in Johannesburg in 2002, encourages countries to implement the GHS as soon as possible with a view to having the system fully operational by 2008. In the EU the GHS implementation started in 2009 and until 2015 the EU symbols can be also used.

Implementation of effective chemical hazard communication based on GHS provides benefits for governments, companies, workers and consumers. The GHS has maximum value if accepted in all major regulatory systems for chemical hazard communication worldwide.

Chemicals are manufactured and traded globally and their hazards are the same around the world. Therefore the description of hazards should not differ between countries since the product is the same

Visit the GHS site in the internet at:



www.unece.org/trans/danger/ghs/pictograms.html

Visit site on EU Regulation on classification, labeling and packaging (CLP) based on GHS at:



echa.europa.eu/clp_en.asp

Some examples for GHS pictograms for physical, health and environment hazards are given below.

Pictograms for labeling hazardous substances according to GHS that are used in the EU from 2009 onwards and the corresponding hazard classes are shown on the next page.



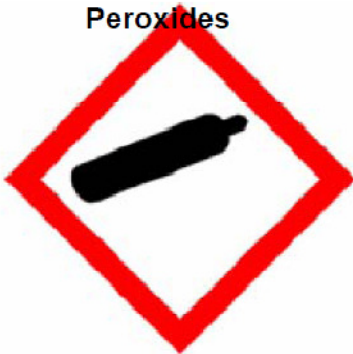
GHS 01
Explosives, Self
Reactives, Organic
Peroxides



GHS 02
Flammables, Self Reactives,
Pyrophorics, Self Heating,
Organic Peroxides



GHS 03
Oxidizers



GHS 04
Gases under
(severe)
pressure



GHS 05
Corrosives



GHS 06
Acute Toxicity



GHS 07
Irritant, Dermal sensitiser,
Acute toxicity (harmful),
Respiratory tract irritation



GHS 08
Carcinogenic, Respiratory
Sensitizer, Reproductive
toxicity, Mutagenicity,
Target organ toxicity,
Aspiration toxicity



GHS 09
Environmental Toxicity

Figure 15 – GHS-pictograms and their meanings

Topic 2a: EU Risk (R) and Safety (S) Phrases for hazardous substances

Hazard, risk and the probability of a chemical causing harm are reflected in an internationally accepted system of risk phrases (R-Phrases) and safety phrases (S-Phrases) and in used in the EU.

Many **R-Phrases** refer to health effects on humans (e.g. R34 means that the chemical ‘causes burns’). Other R-Phrases describe environmental effects (e.g. R50 means that a substance is very toxic to aquatic organisms).

Certain R-Phrases also indicate that chemicals can be explosive or flammable, or react violently with water or oxidizing substances. It is important to know this and take special care during handling or storage of these chemicals.

S-Phrases provide first advice for the safe handling of hazardous chemical substances and

formulations (e.g. S34 means ‘avoid shock and friction’)

R-Phrases and S-Phrases can appear alone or in combination. This is indicated by a ‘/’ between the numbers; e.g. R36/37 means that the chemical is both ‘irritating to eyes’ and ‘irritating to respiratory system’.

Where to find R-Phrases and S-Phrases?

These phrases are normally found on the product label (with or without the corresponding R- code number) (see Figure 10a) and on the Safety Data Sheet (SDS) (see Figure 10b). In the tables on the next pages you will find a list of R-Phrases and S-Phrases as well as the corresponding hazard groups for inhalation, skin absorption and fire and explosions.

R-Phrases indicate hazards!

**S-Phrases provide first advice
for the safe handling!**

Locating the R-Phrase on a Product Label

<p>Xn Gesundheitsschädlich Harmful Nocif</p> <p>N Umweltgefährlich Dangerous for the environment Dangereux pour l'environnement</p> <p>Nocivo Schadelijk Nocivo</p> <p>Pericoloso per l'ambiente Milieugevaarlijk Peligoso para el medio ambiente</p>	<p>2-Naphthol (D)</p> <ul style="list-style-type: none"> - Gesundheitsschädlich beim Einatmen und Verschlucken. - Sehr giftig für Wasserorganismen. - Staub nicht einatmen. - Berührung mit den Augen und der Haut vermeiden. - Bei Berührung mit den Augen sofort gründlich mit Wasser abspülen und Arzt konsultieren. - Bei der Arbeit geeignete Schutzkleidung, Schutzhandschuhe und Schutzbrille/Gesichtsschutz tragen. 	<p>2-naftolo (I)</p> <ul style="list-style-type: none"> - Nocivo per inalazione e ingestione. - Altamente tossico per gli organismi acquatici. - Non respirare le polveri. - Evitare il contatto con gli occhi e con la pelle. - In caso di contatto con gli occhi, lavare immediatamente e abbondantemente con acqua e consultare un medico. - Usare indumenti protettivi e guanti adatti e proteggersi gli occhi/la faccia.
	<p>2-naphthol (GB)</p> <ul style="list-style-type: none"> - Harmful by inhalation and if swallowed. - Very toxic to aquatic organisms. - Do not breathe dust. - Avoid contact with eyes and skin. - In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. - Wear suitable protective clothing, gloves and eye/face protection. <p style="text-align: center;">R-Phrases (no number)</p>	<p>2-naftol (NL)</p> <ul style="list-style-type: none"> - Schadelijk bij inademing en opname door de mond. - Zeer vergiftig voor in het water levende organismen. - Stof niet inademen. - Aanraking met de ogen en de huid vermijden. - Bij aanraking met de ogen onmiddellijk met overvloedig water afspoelen en deskundig medisch advies inwinnen. - Draag geschikte beschermende kleding, handschoenen en een beschermingsmiddel voor de ogen / voor het gezicht.
	<p>2-naphtol (F)</p> <ul style="list-style-type: none"> - Nocif par inhalation et ingestion. - Très toxique pour les organismes aquatiques. - Ne pas respirer les poussières. - Eviter le contact avec la peau et les yeux. - En cas de contact avec les yeux, laver immédiatement et abondamment avec de l'eau et consulter un spécialiste. - Porter un vêtement de protection approprié, des gants et un appareil de protection des yeux/du visage. 	<p>2-naftol (E)</p> <ul style="list-style-type: none"> - Nocivo por inhalación y por ingestión. - Muy tóxico para los organismos acuáticos. - No respirar el polvo. - Evítese el contacto con los ojos y la piel. - En caso de contacto con los ojos, lávese inmediatamente y abundantemente con agua y acúdase a un médico. - Úsense indumentaria y guantes adecuados y protección para los ojos/ la cara.

Figure 16 a – R-phrase on a product label

Locating the R-Phrase on a MSDS (2-Naphtol 98%)

MSDS for 2-Naphthol, 98%
**** MATERIAL SAFETY DATA SHEET ****

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 2-Naphthol, 98%
 Catalog Numbers: 15697-0000, 15697-0010, 15697-0025
 Synonyms: 2-Hydroxynaphthalene; beta-naphthol
 Company Identification (Europe): Acros Organics BVBA
 Janssen Pharmaceuticaaan 3a
 2440 Geel, Belgium

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
135-19-3	2-Naphthol	98%	205-182-7

Hazard Symbols: XN N
 Risk Phrases: 20/22 50

R-Phrases
with corresponding numbers

Figure 16 b – R-phrase on an MSDS

List of EU Risk phrases (R-Phrases), their meaning and other correspondances

Risk Phrases		GHS ⁴ Hazard State- ment code equiva- lent	ILO Hazard group inha- lation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group ingest- ion
R1	Explosive when dry	EUH 001		Physi- cal D		
R2	Risk of explosion by shock, friction, fire or other sources of ignition	Not direct translation possible		Physi- cal D		
R3	Extreme risk of explosion by shock, friction, fire or other sources of ignition	Not direct translation possible		Physi- cal D		
R4	Forms very sensitive explosive metallic compounds			Physi- cal D		
R5	Heating may cause an explosion			Physi- cal C		
R6	Explosive with or without contact with air	EUH 006		Physi- cal C		
R7	May cause fire	H 242		Physi- cal C		
R8	Contact with combustible material may cause fire	gas	H 270	Physi- cal C		
		Liq., solid	Not direct translation possible			

⁴ See translation table in annex vii of CLP regulation at: <http://ec.europa.eu/enterprise/sectors/chemicals/documents/classification/>

Risk Phrases		GHS ⁴ Hazard Statement code equiva- lent	ILO Hazard group inhalation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group ingestion
		ble				
R9	Explosive when mixed with combustible material	H 271		Physical C		
R10	Flammable liquid	Not direct translation possible		Physical B		
		Flam. liq. 1	H 224			
		Flam. liq. 2	H 225			
		Flam. liq. 3	H 226			
R11	Highly flammable	Flam. Liq. 1	H 224	Physical C		
		Flam liq. 2	H 225			
R12	Extremely flammable	Flam.gas 1	H 220	Physical C		
		Flam. Gas 2	H 221			
		Flam- liq. 1	H242			
R14	Reacts violently with water	EUH 014		Physical C		
R14/15	Reacts violently with water, liberating extremely flammable gases			Physical C		
R15	Contact with water liberates extremely flammable gases	Not direct translation possible		Physical C		
R15/29	Contact with water liberates toxic, extremely			Physical		

Risk Phrases		GHS ⁴ Hazard Statement code equiva- lent	ILO Hazard group inhalation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group ingestion
	flammable gases			cal C		
R16	Explosive when mixed with oxidizing substances			Physi- cal C		
R17	Spontaneously flammable in air	H 250		Physi- cal D		
R18	In use, may form flammable/explosive vapor-air mixture	EUH 018		Physi- cal C		
R19	May form explosive peroxides	EUH 019		Physi- cal D		
R20	Harmful by inhalation	H 332	B			
R20/21	Harmful by inhalation and in contact with skin					
R20/21/22	Harmful by inhalation, in contact with skin and if swallowed					
R20/22	Harmful by inhalation and if swallowed					
R21	Harmful in contact with skin	H 312		Skin C		
R21/22	Harmful in contact with skin and if swallowed					
R22	Harmful if swallowed	H 302				B
R23	Toxic by inhalation	vapor	C			
		Dust/mist, gas				
R23/24	Toxic by inhalation and in contact with skin					
R23/24/25	Toxic by inhalation, in contact with skin and if					

Risk Phrases		GHS ⁴ Hazard Statement code equiva- lent	ILO Hazard group inhalation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group ingestion
	swallowed					
R23/25	Toxic by inhalation and if swallowed					
R24	Toxic in contact with skin	H 311		Skin D and Skin E (in combi- nation with R34)		
R24/25	Toxic in contact with skin and if swallowed					
R25	Toxic if swallowed	H 301				C
R26	Very toxic by inhalation	H 330	D			
R26/27	Very toxic by inhalation and in contact with skin					
R26/27/28	Very toxic by inhalation, in contact with skin and if swallowed					
R26/28	Very toxic by inhalation and if swallowed					
R27	Very toxic in contact with skin	H 310		Skin E		
R27/28	Very toxic in contact with skin and if swallowed					
R28	Very toxic if swallowed	H 300				D
R29	Contact with water liberates toxic gas	EUH 029	C			
R30	Can become highly flammable in use			Physical C		

Risk Phrases		GHS ⁴ Hazard Statement code equiva- lent	ILO Hazard group inhalation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group ingestion
R31	Contact with acids liberates toxic gas	EUH 031	C			
R32	Contact with acids liberates very toxic gas	EUH 032	D			
R33	Danger of cumulative effects	H 373				
R34	Causes burns	H 314	C	Skin D and Skin E (in combination with R24)	C	C
R35	Causes severe burns	H 314	C	Skin E	C	C
R36	Irritating to eyes	H 319			A	
R36/37	Irritating to eyes and respiratory system		A		A	
R36/37/38	Irritating to eyes, respiratory system and skin		A		A	
R36/38	Irritating to eyes and skin				A	
R37	Irritating to respiratory system	H 335	A			
R37/38	Irritating to respiratory system and skin		A			
R38	Irritating to skin	H 315		Skin B		
R39	Danger of very serious irreversible effects	EUH 070				
R39/23	Toxic: danger of very serious irreversible effects	H 370	C			

Risk Phrases		GHS ⁴ Hazard Statement code equiva- lent	ILO Hazard group inhalation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group ingestion
	through inhalation					
R39/23/24	Toxic: danger of very serious irreversible effects through inhalation and in contact with skin					
R39/23/24/25	Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed					
R39/23/25	Toxic: danger of very serious irreversible effects through inhalation and if swallowed					
R39/24	Toxic: danger of very serious irreversible effects in contact with skin	H 370		Skin D		
R39/24/25	Toxic: danger of very serious irreversible effects in contact with skin and if swallowed					
R39/25	Toxic: danger of very serious irreversible effects if swallowed	H 370				C
R39/26	Very Toxic: danger of very serious irreversible effects through inhalation	H 370	D			
R39/26/27	Very Toxic: danger of very serious irreversible effects through inhalation and in contact with skin					
R39/26/27/28	Very Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed					

Risk Phrases		GHS ⁴ Hazard Statement code equiva- lent	ILO Hazard group inhalation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group ingestion
	lowed					
R39/26/28	Very Toxic: danger of very serious irreversible effects through inhalation and if swallowed					
R39/27	Very Toxic: danger of very serious irreversible effects in contact with skin	H 370		Skin E		
R39/27/28	Very Toxic: danger of very serious irreversible effects in contact with skin and if swallowed					
R39/28	Very Toxic: danger of very serious irreversible effects if swallowed	H 370 EUH 070				
R40	Limited evidence of a carcinogenic effect	H 351	C	Skin D	C	C
R41	Risk of serious damage to eyes	H 318 EUH 070			B	
R42	May cause sensitization by inhalation	H 334	C			
R43	May cause sensitization by skin contact	H 317		Skin C		
R42/43	May cause sensitization by inhalation and skin contact					
R44	Risk of explosion if heated under confinement	EUH 044		Physical C		
R45	May cause cancer	H350	E	Skin E	E	E
R46	May cause heritable genetic damage	H 340	E	Skin E	E	E

Risk Phrases		GHS ⁴ Hazard Statement code equiva- lent	ILO Hazard group inhalation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group inges- tion
R48	Danger of serious damage to health by prolonged exposure					
R48/20	Harmful: danger of serious damage to health by prolonged exposure through inhalation	H 373	C			
R48/20/21	Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin					
R48/20/21/2	Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed					
R48/20/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed					
R48/21	Harmful: danger of serious damage to health by prolonged exposure in contact with skin	H 373		Skin C		
R48/21/22	Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed					
R48/22	Harmful: danger of serious damage to health by prolonged exposure if swallowed	H 373				C
R48/23	Toxic: danger of serious damage to health by prolonged exposure through	H 372	D			

Risk Phrases		GHS ⁴ Hazard Statement code equiva- lent	ILO Hazard group inha- lation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group ingest- ion
	inhalation					
R48/23/24	Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin					
R48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed					
R48/23/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed					
R48/24	Toxic: danger of serious damage to health by prolonged exposure in contact with skin	H 372				
R48/24/25	Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed					
R48/25	Toxic: danger of serious damage to health by prolonged exposure if swallowed	H 372				D
R49	May cause cancer by inhalation	H 350i	E			
R50	Very toxic to aquatic organisms	H 400 H 410				
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the					

Risk Phrases		GHS ⁴ Hazard Statement code equiva- lent	ILO Hazard group inhalation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group ingestion
	aquatic environment					
R51	Toxic to aquatic organisms	H 400 H 410 H 411				
R51/53	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment					
R52	Harmful to aquatic organisms	H 400 H 410 H 411				
R52/53	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment					
R53	May cause long-term adverse effects in the aquatic environment	H 413 H 411				
R54	Toxic to flora					
R55	Toxic to fauna					
R56	Toxic to soil organisms					
R57	Toxic to bees					
R58	May cause long-term adverse effects in the environment					
R59	Dangerous for the ozone layer	EUH 059				
R60	May impair fertility	Repr. 1A H 360F H 360FD	E	Skin E		

Risk Phrases			GHS ⁴ Hazard Statement code equiva- lent	ILO Hazard group inhalation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group ingestion
			H 360Fd				
		Repr. 1B	H 360F H 360FD H 360 d				
R61	May cause harm to the unborn child	Repr. 1A	H 360D H 360FD H 360Df	D	Skin E	D	D
		Repr. 1B	H 360D H 360Df				
R62	Possible risk of impaired fertility	Repr. 1A	H 360Df	C	Skin D	C	C
		Repr. 1B	H 360 Df				
		Repr. 2	H 361f				
R63	Possible risk of harm to the unborn child	Repr.1A	H 360Fd	C		C	C
		Repr. 1B	H 360 Fd				
		Repr. 2	H 361d				
R64	May cause harm to breast-fed babies		H 362				
R65	Harmful: may cause lung damage if swallowed		H 304	A			
R66	Repeated exposure may cause skin dryness or		EUH		Skin B		

Risk Phrases		GHS ⁴ Hazard Statement code equiva- lent	ILO Hazard group inhalation	BAuA Hazard group skin/p hysical	ILO Hazard group eye dam- ages	ILO Hazard group ingestion
	cracking	066				
R67	Vapors may cause drowsiness and dizziness	H 336	A			
R68	Possible risk of irreversible effects	H 341	C	Skin D	C	C
R68/20	Harmful: possible risk of irreversible effects through inhalation	H 371	B			
R68/20/21	Harmful: possible risk of irreversible effects through inhalation and in contact with skin					
R68/20/21/2	Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed					
R68/20/22	Harmful: possible risk of irreversible effects through inhalation and if swallowed		B			B
R68/21	Harmful: possible risk of irreversible effects in contact with skin	H 371	Skin C			
R68/21/22	Harmful: possible risk of irreversible effects in contact with skin and if swallowed					
R 68/22	Harmful: possible risk of irreversible effects if swallowed	H 371				

List of EU Safety Phrases (S-Phrases) and their meaning

Code	Meaning
S1	Keep locked up.
S1/2	Keep locked up and out of the reach of children.
S2	Keep out of the reach of children.
S3	Keep in a cool place.
S3/7	Keep container tightly closed in a cool place.
S3/9/14	Keep in a cool, well-ventilated place away from incompatible materials (to be indicated by the manufacturer)
S3/9/14/49	Keep only in the original container in a cool, well-ventilated place away from ... (incompatible materials to be indicated by the manufacturer).
S 3/9/49	Keep only in original container in a cool, well-ventilated place.
S3/14	Keep in a cool place away from ... (incompatible materials to be specified by the manufacturer).
S 4	Keep away from living quarters.
S5	Keep contents under ... (appropriate liquid to be specified by the manufacturer).
S6	Keep under ... (inert gas to be specified by the manufacturer).
S7	Keep container tightly closed.
S7/8	Keep container tightly closed and dry.
S7/9	Keep container tightly closed and in a well-ventilated place.
S7/47	Keep container tightly closed and at a temperature not exceeding ... °C (to be specified by the manufacturer).
S8	Keep container dry.
S9	Keep container in a well-ventilated place.
S12	Do not keep the container sealed.
S13	Keep away from food, drink and animal feeding stuffs.
S14	Keep away from ... (incompatible materials to be indicated by the manufacturer).
S15	Keep away from heat.
S16	Keep away from sources of ignition -- No smoking.

Code	Meaning
S17	Keep away from combustible material.
S18	Handle and open container with care.
S20	When using do not eat or drink.
S20/21	When using do not eat, drink or smoke
S21	When using do not smoke.
S22	Do not breathe dust.
S23	Do not breathe gas/fumes/vapor/spray (appropriate wording to be specified by the manufacturer).
S24	Avoid contact with the skin.
S24/25	Avoid contact with skin and eyes.
S25	Avoid contact with eyes.
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S27	Take off immediately all contaminated clothing.
S27/28	After contact with skin, take off immediately all contaminated clothing, and wash immediately with plenty of ... (to be specified by the manufacturer).
S28	After contact with skin, wash immediately with plenty of ... (to be specified by the manufacturer).
S29	Do not empty into drains.
S 29/35	Do not empty into drains; dispose of this material and its container in a safe way.
S 29/56	Do not empty into drains, dispose of this material and its container at hazardous or special waste collection point.
S30	Never add water to this product.
S33	Take precautionary measures against static discharges.
S34	Avoid shock and friction. The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
S35	This material and its container must be disposed of in a safe way.
S36	Wear suitable protective clothing.
S36/37	Wear suitable protective clothing and gloves.

Code	Meaning
S36/37/39	Wear suitable protective clothing, gloves and eye/face protection.
S36/39	Wear suitable protective clothing and eye/face protection.
S37	Wear suitable gloves.
S37/39	Wear suitable gloves and eye/face protection.
S38	In case of insufficient ventilation, wear suitable respiratory equipment.
S39	Wear eye/face protection.
S40	To clean the floor and all objects contaminated by this material, use... (to be specified by the manufacturer).
S41	In case of fire and/or explosion do not breathe fumes.
S42	During fumigation/spraying wear suitable respiratory equipment (appropriate wording to be specified by the manufacturer).
S 43	In case of fire, use ... (indicate in the space the precise type of fire-fighting equipment. If water increases the risk, add 'Never use water')
S44	If you feel unwell, seek medical advice (show label where possible). The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
S45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S46	If swallowed, seek medical advice immediately and show container or label.
S47	Keep at temperature not exceeding .. °C (to be specified by the manufacturer).
S47/49	Keep only in the original container at a temperature not exceeding ... °C (to be specified by the manufacturer).
S48	Keep wet with ... (appropriate material to be specified by the manufacturer).
S49	Keep only in the original container.
S50	Do not mix with ... (to be specified by the manufacturer).
S51	Use only in well-ventilated areas.
S52	Not recommended for interior use on large surface areas.
S53	Avoid exposure -- obtain special instructions before use.
S56	Dispose of this material and its container to hazardous or special waste collection point.

Code	Meaning
S57	Use appropriate container to avoid environmental contamination.
S59	Refer to manufacturer/supplier for information on recovery/ recycling.
S60	This material and its container must be disposed of as hazardous waste.
S61	Avoid release to the environment. Refer to special instructions/safety data sheets.
S62	If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.
S63	In case of accident by inhalation: remove casualty to fresh air and keep at rest.
S64	If swallowed, rinse mouth with water (only if the person is conscious).

Topic 2b: Hazard and Precautionary Statement Codes as per GHS

Under the Global Harmonized Systems (GHS) the equivalent of R-Phrases (see topic2a) is called the Hazard Statement, short H-Statement. In the following table you find all H codes and their meaning as well as the classes and categories of hazards.

Hazard Statement Codes for Physical Hazards

Code	Physical hazard statement	Hazard Class (GHS Chapter)	Hazard Category
H200	Unstable explosive	Explosives (chapter 2.1)	Unstable explosive
H201	Explosive ; mass explosive hazard	Explosives (chapter 2.1)	Division 1.1
H202	Explosive ; severe projection hazard	Explosives (chapter 2.1)	Division 1.2
H203	Explosive ; fire, blast or projection hazard	Explosives (chapter 2.1)	Division 1.3
H204	Fire or projection hazard	Explosives (chapter 2.1)	Division 1.4
H205	May mass explode in fire	Explosives (chapter 2.1)	Division 1.5
H220	Extremely flammable gas	Flammable gases (chapter 2.2)	1
H221	Flammable gas	Flammable gases (chapter 2.2)	2
H222	Extremely flammable aerosol	Flammable aerosols (chapter 2.3)	1
H223	Flammable aerosol	Flammable aerosols (chapter 2.3)	2
H224	Extremely flammable liquid	Flammable liquids (chapter 2.6)	1

Code	Physical hazard statement	Hazard Class (GHS Chapter)	Hazard Category
	and vapor		
H225	Highly flammable liquid and vapor	Flammable liquids (chapter 2.6)	2
H226	Flammable liquid and vapor	Flammable liquids (chapter 2.6)	3
H227	Combustible liquid	Flammable liquids (chapter 2.6)	4
H228	Flammable solid	Flammable solids (chapter 2.7)	1, 2
H240	Heating may cause an explosion	Self-reactive substances and mixtures (chapter 2.8); and Organic peroxides (chapter 2.15)	Type A
H241	Heating may cause a fire or explosion	Self-reactive substances and mixtures (chapter 2.8); and Organic peroxides (chapter 2.15)	Type B
H242	Heating may cause a fire	Self-reactive substances and mixtures (chapter 2.8); and Organic peroxides (chapter 2.15)	Types C, D, E, F
H250	Catches fire spontaneously if exposed to air	Pyrophoric liquids (chapter 2.9); Pyrophoric solids (chapter 2.10)	1
H251	Self-heating ; may catch fire	Self-heating ; substances and mixtures (chapter 2.11)	1
H252	Self-heating ; in large quantities; may catch fire	Self-heating ; substances and mixtures (chapter 2.11)	2
H260	In contact with water releases flammable gases which may ignite spontaneously	Substances and mixtures which, in contact with water, emit flammable gases (chapter 2.12)	1
H261	In contact with water releases flammable gas	Substances and mixtures which, in contact with water, emit flammable gases (chapter 2.12)	2, 3
H270	May cause or intensify fire; oxidizer	Oxidizing gases (chapter 2.4)	1
H271	May cause fire or explosion ; strong oxidizer	Oxidizing liquids (chapter 2.13); Oxidizing solids (chapter 2.14)	1
H272	May intensify fire; oxidizer	Oxidizing liquids (chapter 2.13); Oxidizing solids (chapter 2.14)	2, 3
H280	Contains gas under pressure ; may explode if heated	Gases under pressure (chapter 2.5)	Compressed gas Liquefied gas

Code	Physical hazard statement	Hazard Class (GHS Chapter)	Hazard Category
			Dissolved gas
H281	Contains refrigerated gas; may cause cryogenic burns or injury	Gases under pressure (chapter 2.5)	Refrigerated liquefied gas
H290	May be corrosive to metals	Corrosive to metals (chapter 2.16)	1

Hazard Statement Codes for Health Hazards

Code	Health hazard statement	Hazard Class (GHS Chapter)	Hazard Category
H300	Fatal if swallowed	Acute toxicity , oral (chapter 3.1)	1, 2
H301	Toxic if swallowed	Acute toxicity , oral (chapter 3.1)	3
H302	Harmful if swallowed	Acute toxicity , oral (chapter 3.1)	4
H303	May be harmful if swallowed	Acute toxicity , oral (chapter 3.1)	5
H304	May be fatal if swallowed and enters airways	Aspiration hazard (chapter 3.10)	1
H305	May be harmful if swallowed and enters airways	Aspiration hazard (chapter 3.10)	2
H310	Fatal in contact with skin	Acute toxicity , dermal (chapter 3.1)	1, 2
H311	Toxic in contact with skin	Acute toxicity , dermal (chapter 3.1)	3
H312	Harmful in contact with skin	Acute toxicity , dermal (chapter 3.1)	4
H313	May be harmful in contact with skin	Acute toxicity , dermal (chapter 3.1)	5
H314	Causes severe skin burns and eye damage	Skin corrosion/irritation (chapter 3.2)	1A, 1B, 1C
H315	Causes skin irritation	Skin corrosion/irritation (chapter 3.2)	2
H316	Causes mild skin irritation	Skin corrosion/irritation (chapter 3.2)	3
H317	May cause an allergic skin reaction	Sensitization , skin (chapter 3.4)	1

Code	Health hazard statement	Hazard Class (GHS Chapter)	Hazard Category
H318	Causes serious eye damage	Serious eye damage/eye irritation (chapter 3.3)	1
H319	Causes serious eye irritation	Serious eye damage/eye irritation (chapter 3.3)	2A
H320	Causes eye irritation	Serious eye damage/eye irritation (chapter 3.3)	2B
H330	Fatal if inhaled	Acute toxicity , inhalation (chapter 3.1)	1, 2
H331	Toxic if inhaled	Acute toxicity , inhalation (chapter 3.1)	3
H332	Harmful if inhaled	Acute toxicity , inhalation (chapter 3.1)	4
H333	May be harmful if inhaled	Acute toxicity , inhalation (chapter 3.1)	5
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled	Sensitization , respiratory (chapter 3.4)	1
H335	May cause respiratory irritation	Specific target organ toxicity, single exposure; Respiratory tract irritation (chapter 3.8)	3
H336	May cause drowsiness or dizziness	Specific target organ toxicity, single exposure; Narcotic effects (chapter 3.8)	3
H340	May cause genetic defects (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)	Germ cell mutagenicity (chapter 3.5)	1A, 1B
H341	Suspected of causing genetic defects (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)	Germ cell mutagenicity (chapter 3.5)	2
H350	May cause cancer (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)	Carcinogenicity (chapter 3.6)	1A, 1B

Code	Health hazard statement	Hazard Class (GHS Chapter)	Hazard Category
H351	Suspected of causing cancer (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)	Carcinogenicity (chapter 3.6)	2
H360	May damage fertility or the unborn child (state specific effect if known)(state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)	Reproductive toxicity (chapter 3.7)	1A, 1B
H361	Suspected of damaging fertility or the unborn child (state specific effect if known)(state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)	Reproductive toxicity (chapter 3.7)	2
H362	May cause harm to breast-fed children	Reproductive toxicity , effects on or via lactation (chapter 3.7)	Additional category
H370	Causes damage to organs (or state all organs affected, if known) (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)	Specific target organ toxicity, single exposure (chapter 3.8)	1
H371	May cause damage to organs (or state all organs affected, if known)(state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)	Specific target organ toxicity, single exposure (chapter 3.8)	2
H372	Causes damage to organs (state all organs affected, if known) through prolonged or repeated exposure (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)	Specific target organ toxicity, repeated exposure (chapter 3.9)	1
H373	May cause damage to organs (state all organs affected, if known) through prolonged or repeated exposure (state route	Specific target organ toxicity, repeated exposure (chapter 3.9)	2

Code	Health hazard statement	Hazard Class (GHS Chapter)	Hazard Category
	of exposure if it is conclusively proven that no other routes of exposure cause the hazard)		

Hazard Statement Codes for Environmental Hazards

Code	Environmental hazard statement	Hazard Class (GHS Chapter)	Hazard Category
H400	<u>Very toxic</u> to aquatic life	<u>Hazardous</u> to the aquatic environment, <u>acute toxicity</u> (chapter 4.1)	1
H401	<u>Toxic</u> to aquatic life	<u>Hazardous</u> to the aquatic environment, <u>acute toxicity</u> (chapter 4.1)	2
H402	Harmful to aquatic life	<u>Hazardous</u> to the aquatic environment, <u>acute toxicity</u> (chapter 4.1)	3
H410	<u>Very toxic</u> to aquatic life with long lasting effects	<u>Hazardous</u> to the aquatic environment, <u>chronic toxicity</u> (chapter 4.1)	1
H411	<u>Toxic</u> to aquatic life with long lasting effects	<u>Hazardous</u> to the aquatic environment, <u>chronic toxicity</u> (chapter 4.1)	2
H412	Harmful to aquatic life with long lasting effects	<u>Hazardous</u> to the aquatic environment, <u>chronic toxicity</u> (chapter 4.1)	3
H413	May cause long lasting harmful effects to aquatic life	<u>Hazardous</u> to the aquatic environment, <u>chronic toxicity</u> (chapter 4.1)	4

In the EU the following additional **H codes (EUH)** are in use:

Code	Meaning
EUH 001	Explosive when dry
EUH 006	Explosive with or without contact with air
EUH 014	Reacts violently with water

Code	Meaning
EUH 018	In use may form flammable/explosive vapor-air mixture
EUH 019	May form explosive peroxides
EUH 029	Contact with water liberates toxic gas
EUH 030	Can become highly flammable in use
EUH 031	Contact with acids liberates toxic gas
EUH 032	Contact with acids liberates very toxic gas
EUH 044	Risk of explosion if heated under confinement
EUH 059	Hazardous to the ozone layer
EUH 066	Repeated exposure may cause skin dryness or cracking
EUH 070	Toxic by eye contact
EUH 071	Corrosive to the respiratory tract.
EUH 201	Contains lead. Should not be used on surfaces liable to be chewed or sucked by children. Warning! Contains lead
EUH 202	Cyanoacrylate. Danger. Bonds skin and eyes in seconds. Keep out of the reach of children
EUH 203	Contains chromium (VI). May produce an allergic reaction
EUH 204	Contains isocyanates. See information supplied by the manufacturer.
EUH 205	Contains epoxy constituents. See information supplied by the manufacturer
EUH 206	Warning! Do not use together with other products. May release dangerous gases (chlorine).
EUH 207	Warning! Contains cadmium. Dangerous fumes are formed during use. See information supplied by the manufacturer. Comply with the safety instructions
EUH 208	Contains (name of sensitizing substance). May produce an allergic reaction
EUH 209	Can become highly flammable in use or can become flammable in use
EUH 210	Safety data sheet available on request
EUH 401	To avoid risks to human health and the environment, comply with the instructions for use

In Global Harmonised System (GHS) - Precautionary Statements

The GHS the equivalent to the S-Phrases (see topic 2a) are called Precautionary Statements. Below you find the list with the meaning of all P codes is given. These precautionary statements are divided in:

General precautionary statements

Code	Meaning
P101:	If medical advice is needed, have product container or label at hand
P102:	Keep out of reach of children
P103:	Read label before use

Prevention precautionary statements

Code	Meaning
P201	Obtain special instructions before use
P202	Do not handle until all safety precautions have been read and understood
P210	Keep away from heat/sparks/open flames/hot surfaces – No smoking
P211	Do not spray on an open flame or other ignition source
P220	Keep/Store away from clothing/.../combustible materials
P221	Take any precaution to avoid mixing with combustibles
P222	Do not allow contact with air
P223	Keep away from any possible contact with water, because of violent reaction and possible flash fire
P230	Keep wetted with ...
P231	Handle under inert gas
P232	Protect from moisture
P233	Keep container tightly closed
P234	Keep only in original container
P235	Keep cool
P240	Ground/bond container and receiving equipment

Code	Meaning
P241	Use explosion-proof electrical/ventilating/light/.../equipment
P242	Use only non-sparking tools
P243	Take precautionary measures against static discharge
P244	Keep reduction valves free from grease and oil
P250	Do not subject to grinding/shock/.../friction
P251	Pressurized container – Do not pierce or burn, even after use
P260	Do not breathe dust/fume/gas/mist/vapours/spray
P261	Avoid breathing dust/fume/gas/mist/vapours/spray
P262	Do not get in eyes, on skin, or on clothing
P263	Avoid contact during pregnancy/while nursing
P264	Wash ... thoroughly after handling
P270	Do not eat, drink or smoke when using this product
P271	Use only outdoors or in a well-ventilated area
P272	Contaminated work clothing should not be allowed out of the workplace
P273	Avoid release to the environment
P280	Wear protective gloves/protective clothing/eye protection/face protection
P281	Use personal protective equipment as required
P282	Wear cold insulating gloves/face shield/eye protection
P283	Wear fire/flame resistant/retardant clothing
P284	Wear respiratory protection
P285	In case of inadequate ventilation wear respiratory protection
P231+232	Handle under inert gas. Protect from moisture
P235+410	Keep cool. Protect from sunlight

Response precautionary statements

Code	Meaning
P301	IF SWALLOWED
P302	IF ON SKIN
P303	IF ON SKIN (or hair)
P304	IF INHALED
P305	IF IN EYES
P306	IF ON CLOTHING
P307	IF exposed
P308	IF exposed or concerned
P309	IF exposed or you feel unwell
P310	Immediately call a POISON CENTER or doctor/physician
P311	Call a POISON CENTER or doctor/physician
P312	Call a POISON CENTER or doctor/physician if you feel unwell
P313	Get medical advice/attention
P314	Get Medical advice/attention if you feel unwell
P315	Get immediate medical advice/attention
P320	Specific treatment is urgent (see ... on this label)
P321	Specific treatment (see ... on this label)
P322	Specific measures (see ... on this label)
P330	Rinse mouth
P331	Do NOT induce vomiting
P332	If skin irritation occurs
P333	If skin irritation or a rash occurs
P334	Immerse in cool water/wrap in wet bandages
P335	Brush off loose particles from skin
P336	Thaw frosted parts with lukewarm water. Do not rub affected areas

Code	Meaning
P337	If eye irritation persists
P338	Remove contact lenses if present and easy to do. continue rinsing
P340	Remove victim to fresh air and keep at rest in a position comfortable for breathing
P341	If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing
P342	If experiencing respiratory symptoms
P350	Gently wash with soap and water
P351	Rinse continuously with water for several minutes
P352	Wash with soap and water
P353	Rinse skin with water/shower
P360	Rinse immediately contaminated clothing and skin with plenty of water before removing clothes
P361	Remove/Take off immediately all contaminated clothing
P362	Take off contaminated clothing and wash before reuse
P363	Wash contaminated clothing before reuse
P370	In case of fire
P371	In case of major fire and large quantities
P372	Explosion risk in case of fire
P373	DO NOT fight fire when fire reaches explosives
P374	Fight fire with normal precautions from a reasonable distance
P375	Fight fire remotely due to the risk of explosion
P376	Stop leak if safe to do so
P377	Leaking gas fire – do not extinguish unless leak can be stopped safely
P378	Use ... for extinction
P380	Evacuate area
P381	Eliminate all ignition sources if safe to do so

Code	Meaning
P301+310	IF SWALLOWED - Immediately call a POISON CENTER or doctor/physician
P301+312	IF SWALLOWED - Call a POISON CENTER or doctor/physician if you feel unwell
P301+330+331	IF SWALLOWED - Rinse mouth. Do NOT induce vomiting
P302+334	IF ON SKIN -Immerse in cool water/wrap in wet bandages
P302+350	IF ON SKIN -Gently wash with soap and water
P302+352	IF ON SKIN Wash with soap and water
P303+361+353	IF ON SKIN (or hair) - Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304+312	IF INHALED - Call a POISON CENTER or doctor/physician if you feel unwell
P304+340	IF INHALED - Remove victim to fresh air and keep at rest in a position comfortable for breathing
P304+341	IF INHALED - If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing
P305+351+338	IF IN EYES - Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing
P306+360	IF ON CLOTHING - Rinse immediately contaminated clothing and skin with plenty of water before removing clothes
P307+311	IF exposed - Call a POISON CENTER or doctor/physician
P308+313	IF exposed or concerned - Get medical advice/attention
P309+311	IF exposed or you feel unwell - Call a POISON CENTER or doctor/physician
P332+313	If skin irritation occurs - Get medical advice/attention
P333+313	If skin irritation or a rash occurs - Get medical advice/attention
P335+334	Brush off loose particles from skin. Immerse in cool water/wrap in wet bandages
P337+313	Get medical advice/attention
P342+311	Call a POISON CENTER or doctor/physician
P370+376	In case of fire - Stop leak if safe to do so

Code	Meaning
P370+378	In case of fire - Use ... for extinction
P370+380	In case of fire - Evacuate area
P370+380+375	In case of fire - Evacuate area. Fight fire remotely due to the risk of explosion
P371+380+375	In case of major fire and large quantities - Evacuate area. Fight fire remotely due to the risk of explosion

Storage precautionary statements

Code	Meaning
P401	Store ...
P402	Store in a dry place
P403	Store in a well ventilated place
P404	Store in a closed container
P405	Store locked up
P406	Store in a corrosive resistant/... container with a resistant inner liner
P407	Maintain air gap between stacks/pallets
P410	Protect from sunlight
P411	Store at temperatures not exceeding ... °C/... °F
P412	Do not expose to temperatures exceeding 50 °C/122 °F
P420	Store away from other materials
P422	Store contents under ...
P402+404	Store in a dry place. Store in a closed container
P403+233	Store in a well ventilated place. Keep container tightly closed
P403+235	Store in a well ventilated place. Keep cool
P410+403	Protect from sunlight. Store in a well ventilated place
P410+412	Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122 °F
P411+235	Store at temperatures not exceeding ... °C/... °F. Keep cool

Disposal precautionary statements

Code	Meaning
P501	Dispose of contents/container to ...

Topic 3a: Using (Material) Safety Data Sheets (M)SDS

Purpose of (Material) Safety Data Sheets - (M) SDS:

- Provides valuable information that you can use to optimize chemical use and improve workplace health & safety standards.
- Indicates characteristics, properties and quality of the chemical having influence on the end product.
- Allows you to determine chemical compatibility and do proper mixing.
- Gives information about proper storage & handling (e.g. ventilation).
- Enables you to prevent losses from the expiry of materials.
- Indicates appropriate security precautions and needed controls, including the use of personal protection equipment (PPE).
- Spells out emergency procedures in case of spills, fire, or explosion.
- Indicates steps for first-aid.
- Specifies the hazard level, which gives clues about the possible effects on water, soil and human health.
- Specifies the flashpoint (the lowest temperature at which a chemical releases flammable vapor). The lower the flashpoint, the more hazardous the chemical is as a source of fuel for fire or explosion.
- Specifies the boiling point, which is used to determine volatility. The lower the boiling point, the higher the volatility.
- Specifies the vapor pressure which is also used to determine volatility⁵

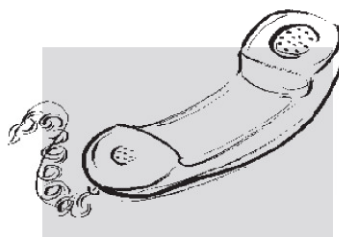
Where to keep (Material) Safety Data Sheets?

An SDS for every chemical substance used in your operation should be kept in a central place and be readily available for consultation by workers and supervisors.

The information provided on the SDS serves as the basis for providing oral and written instructions to workers (see **Topic6**), and for training workers and supervisors in the safe use of chemicals. This training should include instructions for workers on how to obtain and use the information provided on the Safety Data Sheet.

From where can you obtain SDS?

Contact the supplier of the chemical.



⁵ The vapor pressure is the pressure of a vapor in thermodynamic equilibrium with its condensed phases in a closed system. All liquids and solids have a tendency to evaporate into a gaseous form, and all gases have a tendency to condense back to their liquid or solid form. The vapor pressure is an indication of a liquid's evaporation rate. It relates to the tendency of particles to escape from the liquid (or a solid). A substance with a high vapor pressure at normal temperatures is often referred to as volatile.

- All chemical providers are legally obliged to prepare and provide information to buyers regarding the hazardous properties of substances.
- Ask your chemical supplier if the SDS can be provided in the local language currently used by the workers of your factory.

Do an internet search:

- The Internet can be a practical source of information on pure substances (e.g. sodium sulfide, nitric acid, etc.) as the characteristics of these substances do not vary by manufacturer.



www.chemexper.com

is a source of information on pure substances (SDSs can be found and printed from this site in English)

For **formulations** made from multiple components (e.g. a lacquer is composed of solvents, pigments, and additives), the supplier of the particular substance is the only source of information about its actual hazards and characteristics.



Sections of a (material) chemical safety data sheet

ASDS usually contains the following information in 16 sections in accordance with the model specified in EU Directive

91/155/EEC as amended by EU Directive 2001/58/EC (MSDS from other countries may have a different structure):

Section	Content
Section 1	gives details of the company issuing the data sheet and further identification of the substance.
Section 2	identifies the material and gives the CAS and other registration numbers.
Section 3	summarizes the major hazards associated with the use of this chemical. The R- and S- Phrases in this section are followed by explanatory text.
Section 4	outlines first aid measures .
Section 5	covers fire fighting procedures and protecting equipment.
Section 6	outlines the procedures to be followed in case of accidental release of the chemical , including methods to be used to clean up spills.
Section 7	is an important section indicating appropriate handling and storage (see Topic8).
Section 8	provides information on regulatory standards for exposure limits , in other words, the maximum permitted concentration of the material in the work environment to which you are allowed to be exposed. It also usually contains information of suitable types of PPE .
Section 9	is self explanatory about physical and chemical properties of the substance.
Section 10	is about stability and reactivity of the substance.
Section 11	outlines the risks to which you may be exposed when using the chemical. It is therefore a section of crucial importance. (Toxicological information).
Section 12	is largely self explanatory about ecological information .
Section 13	deals with disposal considerations , is often not sufficiently detailed for you to be able to undertake disposal yourself. If you need to dispose the chemical after use, ensure that you know how to do this safely.
Section 14	gives transport information , generally from a list of UN codes indicating the dangers associated with the chemical (e.g. flammable, radioactive, very toxic, etc.) and the type of transport which may be used.

Section	Content
Section 15	lists the hazard codes which indicate the principle hazard associated with the chemical and the precautions which should be taken when working with it.
Section 16	is for an additional information such as the name of the person preparing the MSDS, a list of references from which data has been drawn, etc.

See sample SDS on the following pages.

The SDS enables you to determine whether any hazardous chemical agents are present at the workplace and to assess any risk to the health & safety of workers arising from their use and how to control them.

Selection of SDS internet sites:



<http://www.msds.com/>



<http://www.ncsu.edu/ehs/MSDS.htm>

Example of a SDS for 2-Naphthol, 98%

** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

MSDS Name: 2-Naphthol, 98%

Catalog Numbers: 15697-0000, 15697-0010, 15697-0025

Synonyms: 2-Hydroxynaphthalene; beta-naphthol

Company Identification (Europe): Acros Organics BVBA
Janssen Pharmaceuticaaan 3a
2440 Geel, Belgium

Company Identification (USA): Acros Organics
One Reagent Lane
Fairlawn, NJ 07410

For information in North America, call: 800-ACROS-01 For information in Europe, call: 0032(0) 14575211

For emergencies in the US, call CHEMTREC: 800-424-9300 For emergencies in Europe, call:0032(0) 14575299

** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS**

CAS#	Chemical Name	%	EINECS#
135-19-3	2-Naphthol	98%	205-182-7

Hazard Symbols: XN N

Risk Phrases: 20/22 50

** SECTION 3 - HAZARDS IDENTIFICATION** EMERGENCY OVERVIEW

Harmful by inhalation and if swallowed. Very toxic to aquatic organisms. Light sensitive.

Potential Health Effects

Eye: Causes moderate eye irritation.

Skin: Causes mild skin irritation. May be harmful if absorbed through the skin.

Ingestion: Harmful if swallowed. May cause irritation of the digestive tract.

Inhalation: May be fatal if inhaled. Harmful if inhaled. May cause respiratory tract irritation.

Chronic: Prolonged or repeated exposure may cause permanent damage.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion: Do NOT induce vomiting. Get medical aid. Wash mouth out with water.

Inhalation: Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Notes to Physician:

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Extinguishing Media:

Use water spray, dry chemical, carbon dioxide, or chemical foam.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Vacuum or sweep up material and place into a suitable disposal container. Avoid generating dusty conditions.

**** SECTION 7 - HANDLING AND STORAGE ****

Handling:

Minimize dust generation and accumulation. Do not get on skin and clothing. Do not breathe dust, vapor, mist, or gas. Use only in a chemical fume hood.

Storage:

Store in a cool, dry place. Do not store in direct sunlight. Store in a tightly closed container.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:

Use adequate ventilation to keep airborne concentrations low.

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29CFR 191.0.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State: Flakes
Appearance: light brown - beige
Odour: phenol-like - weak odor
pH: Not available.
Vapor Pressure: 7 hPa at 145°C
Viscosity: Not available.
Boiling Point: 285 – 286°C at 760.00mm Hg
Freezing/Melting Point: 120 – 124°C
Autoignition Temperature: Not available.
Flash Point: 160 deg C (320.00° F)
Explosion Limits, lower: Not available.
Explosion Limits, upper: Not available.
Decomposition Temperature: 400°C
Solubility in water: Not available.
Specific Gravity/Density: Molecular Formula: C₁₀H₇OH
Molecular Weight: 144.17

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

Incompatible materials, light.

Incompatibilities with Other Materials:

Strong oxidizing agents, strong bases, acid chlorides, nitric acid, phenols, sulfuric acid, ferric salts, potassium permanganate, acid anhydrides, antipyrine.

Hazardous Decomposition Products:

Carbon monoxide, carbon dioxide.

Hazardous Polymerization: Will not occur

** SECTION 11 - TOXICOLOGICAL INFORMATION **

RTECS#:

CAS# 135-19-3: QL2975000

LD50/LC50:

CAS# 135-19-3:

Draize test, rabbit, eye: 100 mg Moderate;

Draize test, rabbit, skin: 500 mg/24H

Mild;

Inhalation, rat: LC50 = >770 mg/m³/1H;

Oral, rat: LD50 = 1960 mg/kg;

Skin, rabbit: LD50 = >10 gm/kg.

Carcinogenicity: 2-Naphthol - Not listed by ACGIH, IARC, NIOSH, NTP, or

OSHA. Other:

See actual entry in RTECS for complete information.

** SECTION 12 - ECOLOGICAL INFORMATION **

Ecotoxicity:

Fish toxicity: LC50 fathead minnow 3.5 mg/L/96HLC50 rainbow trout 0.12 mg/L/27day Invertebrate toxicity: LC50 Daphnia magna 3.5 mg/L/48HEC50 Selenastrum capricornutum 19 mg/L/4HEC50

Photobacterium phosphoreum 0.275 ppm/5-30 min Microtox test (The Dictionary of Substances and their Effects, 1992).

Other

Avoid entering into waters or underground water.

** SECTION 13 - DISPOSAL CONSIDERATIONS **

Dispose of in a manner consistent with federal, state, and local regulations.

** SECTION 14 - TRANSPORT INFORMATION **

IATA

Shipping Name: TOXIC SOLID, ORGANIC, N.O.S.*

Hazard Class: 6.1

UN Number: 2811

Packing Group:

III

IMO

Shipping Name: TOXIC SOLID, ORGANIC, N.O.S.

Hazard Class: 6.1

UN Number: 2811

Packing Group:

III

RID/ADR

Shipping Name: TOXIC SOLID, ORGANIC, N.O.S.

Hazard Class: 6.1
UN Number: 2811
Packing group: I

**** SECTION 15 - REGULATORY INFORMATION ****

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN N

Risk Phrases:

R 20/22 Harmful by inhalation and if swallowed.

R 50 Very toxic to aquatic organisms.

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.

S 61 Avoid release to the environment. Refer to special instructions/Safety data sheets. WGK (Water Danger/Protection)

CAS# 135-19-3: 2

United Kingdom Occupational Exposure Limits

Canada

CAS# 135-19-3 is listed on Canada's DSL List.

CAS# 135-19-3 is listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 135-19-3: OEL-RUSSIA:STEL 0.1 mg/m³

US FEDERAL

TSCA

CAS# 135-19-3 is listed on the TSCA inventory.

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 9/03/1996 Revision #2 Date: 11/02/1999

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

Common Abbreviations used in SDS

ACG IH	American Conference of Governmental Industrial Hygienists
CAS	Chemical Abstracts Service Registry Number
CFR	Cooperative Fuel Research Committee
CIS	International Health and Occupational Health Centre
DSL/NDSL	Domestic Substances List/No-DSL (Canada)
EINECS	European Inventory of Existing Chemical Substances
EN	European Norm
IARC	International Agency for Research of Cancer
IATA	International Air Transport Association
ILO	International Labour Organization
IMO	International Maritime Organization
IPCS	International Programme of Chemical Safety
IUPAC	International Union of Pure and Applied Chemistry
LC	Lethal concentration
LD	Lethal doses
MSHA	US Department of Labour, Mine Safety and Health Administration
NFPA	National Formulary Pharmaceutical Association
NIOSH	National Institute for Occupational Safety and Health Administration
NTP	National Toxicology Programme
OHSAS	Occupational Health and Safety Assessment Series
OSHA	Occupational Safety and Health Administration

RID/ARD European Agreement for the transport of dangerous goods on railway/on road

RTECS Registry of Toxic Effects of Chemical Substances

TDG Transport Dangerous Goods, Canada

TSCA Toxic Substances Control Act, US

US DOT US Department of Transportation

WGK Class of risks for water, (Wassergefährdungsklasse, Germany)

Under the new European Chemical Regulation “**REACH**” the information that must be included in an SDS is legally binding.

Annex II of the REACH regulation gives the provisions for extended (ex) Safety Data Sheets (SDS).

The draft document can be visited at:



http://reach.bdi.info/DRAFT_New_Annex_II_GHS_SDS_Substance_and_Preparation_EN_26012010.pdf

See different MSDS for the same product under



http://www.shell.com/home/content/chemicals/products_services/our_products/phenol_acetone_nonene/phenol/material_safety_data_search/

and then under launch Shell chemicals MSDS type the word phenol and select a country

You will find different SDS for the same product but following country specific regulations

Topic 3b: Quick reference to International Chemical Safety Cards (ICSC)

Safety Data Sheets (SDS) are often not easily available to small and medium sized enterprises. International organisations such as ILO and WHO have devised a polyglot tool in form of international chemical safety cards (ICSC) which you can access and retrieve as a ready source of information about safe use of chemicals from the following website free-of-charge:



www.ilo.org/public/english/protction/safework/cis/products/icsc/dtasht/a_index.htm

The **ICSC summarizes** essential health and safety **information on chemicals** for their use at the 'shop floor' level by **workers and employers in factories, agriculture, construction and other work places**. ICSCs are not legally binding documents, but consist of a series of standard phrases, mainly summarizing health & safety information collected, verified and peer reviewed by internationally recognized experts, taking into account advice from manufacturers and Poison Control Centers.

Over 1,400 ICSCs are available and may be downloaded in English from the above mentioned ILO web site. The documents may be searched for by ICSC reference number, Chemicals Abstract Service Registry Number (CAS), main name or synonyms. They are available in 15 other languages (including Chinese, Japanese, Korean, Swahili Thai, Urdu, Vietnamese as well as many European languages).

Topic 3c: Quick reference to Pesticide Data Sheets (PDS)

When using pesticides special precautions have to be taken due to their very hazardous nature if they are not handled appropriately⁶.

⁶ [www.pan-germa-](http://www.pan-germa-ny.org/deu/projekte/hochgefahrlche_pestizide.html)

The information tool of choice is the Pesticide Data Sheet (PDS). The PDS contains basic information on the safe use of specific pesticides and can be found under:



www.inchem.org/pages/pds.html



The Pesticide Data Sheets are prepared by the World Health Organization (WHO) in collaboration with the Food and Agricultural Organization (FAO) and provide basic toxicological information on individual pesticides. Priority for issue of PDS is given to substances having a wide use in public health programs and/or in agriculture or having a high or an unusual toxicity record. The data sheets are prepared by scientific experts and peer reviewed. The comments of industry are provided through the industrial association, the Global Crop Protection Federation (GCPF). The data sheets are revised from time to time as required.

Another source of information is the Pesticide Properties Data Base (PPDB) to be downloaded at:



<http://sitem.herts.ac.uk/aeru/footprint/index2.htm>



[ny.org/deu/projekte/hochgefahrlche_pestizide.html](http://www.pan-germa-ny.org/deu/projekte/hochgefahrlche_pestizide.html)

Topic 3d: using effectively written and oral work instructions

Instruction and training are at the core of any chemical management program. Work instructions are an essential element in worker information. It enables the workers to recognize health and safety hazards, and to prevent accidents and injuries.

Using a simple layout and a straightforward language, the work instructions should inform workers of the hazardous substances occurring at the workplace, the hazards to health, the relevant protection measures and how to act in case of an accident. It also serves as the basis for a written and oral instruction which workers must receive annually or before taking up a new activity. It is recommended, that instructed workers should confirm the received and understood instructions / training by signature.

Important elements of a work instruction

In general a work instruction should cover the following points:

- Name (product identification)
- Hazards identification
- Safety measures and safe handling
- Accidental release measures
- First-aid
- Appropriate disposal

The data needed for the content of the work instructions can be generally retrieved from the material safety data sheet (MSDS) of the respective substance.

Further important technical and operational requirements, which may get reflected in your work instructions you can find in the ILO task specific control guidance sheets (see



www.ilo.org/public/english/protecti on/safework/ctrl_ban- ding/toolkit/icct/index.htm

Also consider the according legal requirements in your country and integrate these into the work instructions.

Writing good work instructions may be sometimes too complex, depending on the substances, required operations, corresponding risks and safety requirements. In such case consider the help of an external consultant, who should work closely with you and the concerned employees/workers to adapt the work instructions to the reality of your company.

A written and oral instruction must be given in a simple and straightforward language and after this the worker must sign that he/she was instructed and knows how to behave during routine activities and in the case of an incident/accident. They have to understand that disregarding the work instructions can result in accidents and serious injuries. The use of pictograms, drawings or similar visual presentation can facilitate the communication of the content (e.g. awareness on hazards and for recommending control measures).

You can download pictograms from



<http://forum.cptec.org/index.php?showtopic=305> .

Making effective use of work instructions

It is a great benefit for the employer to have work instructions for hazardous substances, dangerous processes and important steps during the operation in the company.

Make sure that it is clear to everybody in your company that work instructions must be followed. Regard these as a powerful instrument to (a) inform the workers, (b) document the training and the special handling of certain substances and (c) avoid serious injuries.

The work instructions should be in a place in the company where they can easily be seen and read.

Work instructions should be given to the worker when working for the first time with these chemicals, or during a routine training.

Examples of work instructions

Example 1: Work instruction on correct removal of gloves when using corrosive chemicals.



Health and Safety Executive

Correct removal of gloves Reusable gloves (chemically resistant)

Follow the steps shown



Wipe or rinse gloves and remove carefully to protect your skin from contamination

Dispose of gloves in a suitable container

- Always select the correct size gloves
- Use gloves for no longer than one day

Store gloves on a clean surface for re-use



www.hse.gov.uk



Figure 17 – Correct removal of gloves

Example 2 – Work instruction of applying chemicals for the conditioning of boiler water

This example is for ‘Oxystop’. The dosage system is located in a boiler house. Barrels are connected to the dosage device by a feed pipe. The dosage device is connected to the

batching tank by a dosing valve. The barrel, the feed pipe, the dosage device and the batching compose a closed system. Hazards can arise by spillage of the substance when changing the barrels, which shall be remediated with the measures, listed in the work instructions.

WORKAREA	Boiler house	
WORKPLACE:	Water treatment	
Activity:	Change of barrel: Dosage	
Name (product identification)	OXYSTOP Organic oxygen binder, Basis: Diethylhydroxylamin (DEHA) Supplier: Elfa-Oxy-Chemie	
Hazards identification		<ul style="list-style-type: none"> • Irritates the eyes, the respiratory organs and the skin • Hazardous for water, class of risks for water 2 • Must not be delivered into draining/sewage
Safety measures and safe handling		<ul style="list-style-type: none"> • Transport barrel onto the working platform only with hoisting basket and hoisting equipment! • When connecting the container to the feed pipe wear rubber gloves (gloves for protection of acids) and protective goggles!

Accidental release measures		<ul style="list-style-type: none"> • Leakages in the dosage system have to be reported immediately to the general management! • In case of release of large amounts of Oxystop (e.g. for the upset of the container) wear a mask for full protection with composite filter A2-P3 (brown)! • Treat spilled liquid with Hydroperls, call fire brigade
First aid		<ul style="list-style-type: none"> • When getting Oxystop in touch with the eyes rinse the eyes thoroughly and seek medical advice! • Take off dragged, soaked clothes immediately, and clean moistened skin thoroughly with water! • If swallowed call on works doctor and show label or MSDS (material safety data sheet)!
Appropriate disposal	<ul style="list-style-type: none"> • Oxystop must not get into the drainage / sewer! • Treat leakages with Hydroperls and call the fire brigades for disposal! • Give back empty containers to the storehouse! 	

Example 3 – Work instruction on safe use of glutaraldehyde






Ref. No.:	Work Instruction	
Date:	Hazardous Chemicals	
Responsible:		
Department:	Workplace/Operation:	
1. NAME (PRODUCT IDENTIFICATION)		
	1.5% AQUEOUS GLUTARALDEHYDE SOLUTION (ACTIVATED)	
2. HAZARDS IDENTIFICATION		
	<p>Routes of Entry: Inhalation, Skin, Ingestion</p> <p>Effects of Overexposure:</p> <p><u>Eye:</u> Contact with eyes causes damage.</p> <p><u>Skin:</u> Can cause irritation, sensitization or allergic contact dermatitis, avoid skin contact.</p> <p><u>Inhale:</u> Vapors may be irritating and cause headache, chest discomfort, symptoms of bronchitis or asthma.</p> <p><u>Ingest:</u> May cause nausea, vomit, and general systemic illness.</p>	
		
3. SAFETY MEASURES AND SAFE HANDLING		
	<p>Handling and Storage Precautions: Use normal storage & handling requirements.</p> <p>Other Precautions: None specified by Manufacturer.</p> <p>Respiratory Protection:</p> <p><u>Routine:</u> None required.</p> <p><u>Emergency:</u> Organic vapor cartridge mask or self-contained breathing apparatus.</p> <p>Ventilation:</p> <p><u>Routine:</u> Should be used in cover containers with tight fit lid. Use with standard room ventilated (air conditioning) with minimum of 10 air changes/hr (supply)</p> <p>Protective Gloves:</p> <p><u>Routine:</u> Natural latex, nitrile, butyl (other products equivalent); <u>Caution:</u> Don't use neoprene rubber or Vinyl as Glutaraldehyde may rapidly permeate through material.</p> <p>Eye Protection:</p> <p><u>Routine:</u> Safe glass (goggles)</p> <p><u>Emergency:</u> Safe glass (goggles), Face shield</p> <p>Other Protective Equipment:</p> <p><u>plastic apron</u></p> <p><u>Work Hygienic Practices:</u> Avoid contamination of food.</p> <p><u>Emergency:</u> gloves - listed above, protective clothing, rubber boots</p>	
		
		
4. ACCIDENTAL RELEASE MEASURES		
	<p>Spill Release Procedures:</p> <p><u>Large spills:</u> Use ammonium carbonate to "neutralize" glutaraldehyde odor. Collect liquid & discard it.</p> <p><u>Small spills:</u> Wipe with sponge or mop down area with equal mixture of household ammonia & water. Flush with Large quantities of water.</p>	
5. FIRST AID		
	<p>First Aid:</p> <p><u>Eye:</u> Flush thoroughly with water. Get medical attention.</p> <p><u>Skin:</u> Flush thoroughly with water. If irritation persists get medical attention.</p> <p><u>Inhale:</u> Remove to fresh air. If symptoms persist get medical attention.</p> <p><u>Ingest:</u> Do not induce vomiting. Drink copious amounts of milk. Get medical attention.</p>	
6. APPROPRIATE DISPOSAL		
	<p>Waste Disposal Methods: Triple rinse empty container with water. Dispose in incinerator or landfill approved for pesticide containers. Discard solution With Large Quantity of water.</p>	
Date:		
Prepared/Revised:	Checked:	
Signature:	Signature:	

Figure 18 – Work instructions for glutaraldehyde

Topic 4a: Identifying inhalation hazard groups

Distinguishing between increasing levels of hazard for human health

The International Labor Organization (ILO) has categorized the existing R-Phrases (see table 1a) into five hazard groups based on increasing hazard (Groups A to E). The hazard groups can be assigned to each chemical depending on the corresponding R-Phrase (see table 1a) or H-statement (see table 1b) of the chemical.

For example: A substance with an R-Phrase and/or its combinations that lead to the chemical to be categorized in Group C is more hazardous than a substance that falls in Group A or B. Group E substances are the most hazardous.



Table 1a: The ILO Classification of Inhalation Hazard Groups as A to E for Chemicals causing harm when inhaled is based on their links to certain R-Phrases, as modified in 2010 by **BAuA**

Inhalation Hazard group	R-Phrase
E	R45, R46, R49, R60
D	R26, R28, R32, R61, R39/26, R39/28, R48/23, R48/25
C	R23, R25, R29, R31, R34, R35, R40, R42, R62, R63, R68, R39/23, R39/25, R48/20, R48/22
B	R20, R22, R41, R68/20, R68/22
A	R36, R37, R65, R67 and all chemicals without an R-Phrase

Table 1b: The ILO Classification of Inhalation Hazard Groups as A to E for Chemicals causing harm when inhaled is based on their links to certain H statement Codes, as modified in 2010 by **BAuA**

Inhalation Hazard group	H-statement Code
E	H340, H350, H350i, H360F
D	H300, H330, H360D, H372, EUH032
C	H301, H331, H314, H334, H341, H351, H361f, H361d, H370, H371, H373, EUH031;
B	H302, H332, H318,
A	H319, H335, H336, H304 and all chemicals without a H-code

Alternatively you can determine the hazard group by looking at the occupational exposure limits (OEL). An **occupational exposure limit** is an upper limit on the acceptable concentration of a hazardous substance in workplace air for a particular material or class of materials. It is typically set by competent national authorities and enforced by legislation to protect occupational safety and health. It can be a tool in risk assessment and in the management of activities involving handling of dangerous substances. There are many dangerous substances for which there are no formal occupational exposure limits. In these cases, control banding strategies can be used to ensure safe handling. List of OELs can be found in the internet at e. g.



www.technikwissen.de/library/common/Schmitz-Felten.pdf or ACGIH.

You can find the OEL in the safety data sheets (section 8).

Table 1c: The ILO Classification of Inhalation Hazard Groups as A to E for Chemicals causing harm when inhaled is based on their links to OEL values, as modified in 2010 by **BAuA**

Inhalation Hazard group	OEL	
	Solids (mg/m ³)	Liquids (ppm)
E	OEL<0,001	OEL <0,05
D	0,001<OEL<0,01	0,05<OEL<0,5
C	0,01<OEL<0,1	0,5<OEL<5
B	0,1<OEL<1	5<OEL<50
A	1<OEL<10	50<OEL<500

Topic 5a: Identifying skin hazard groups

The simplest way for chemicals to harm the body is through direct contact with the skin or eyes. When the skin gets in contact with a chemical, this may result in a local reaction, such as a sensitization, allergies, burn, rash or absorption into the bloodstream. Absorption into the bloodstream may then allow the chemical to cause toxic effects on other parts of within the body. Local reactions as well as toxic effects caused by absorption can be very painful and can affect adversely both work and social life. How quickly a disease caused by skin contact develops, depends on the hazardous properties of the substance and how much/how often it comes in contact with the skin.

To categorize the hazardous properties of chemicals the German Federal Institute for Occupational Safety and Health (BAuA) has linked R-Phrases as well as H-statements of chemicals causing harm when in contact or absorbed by skin into 5 different hazard groups (Skin A – Skin E) based on increasing hazard. Group Skin E substances are the most hazardous. The least hazardous are allocated to skin hazard group A.

Table 2a: BAuA classification (based on R-Phrases) of Skin Hazard Groups (Skin A-E) for chemicals causing harm via skin, BAuA 2009

Skin Hazard group	R-Phrase
Skin E	R24 and R34, R27, R35, R39/27, R45, R46, R60, R61,
Skin D	R24, R34, R40, R39/24, R48/24, R62, R63, R68
Skin C	R21, R43, R48/21, R68/21,
Skin B	R38
Skin A	R66

You can also determine the skin hazard group relating them to H-codes:

Table 2b: BAuA classification (based on H-statements) of Skin Hazard Groups (Skin A-E) for chemicals causing harm via skin, BAuA 2009

Skin Hazard group	H-code
Skin E	H310; H314; H340; H350;H360
Skin D	H311; H314, H341; H351; H361; H370*; H372*
Skin C	H312; H317, H371; H373
Skin B	H315
Skin A	EUH066

Corrosive





Published by:

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

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Layout: Harald Flohr
Photos: © Stone Images; © GIZ /Wolfgang A. Schimpf
Illustrations: © Wedha and Stöber

Bonn, October 2011

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH was formed on 1 January 2011. It has brought together under one roof the capacities and long-standing experience of three organisations: the Deutscher Entwicklungsdienst (DED) gGmbH (German Development Service), the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (German technical cooperation) and Inwent – Capacity Building International, Germany. For further information go to www.giz.de.