Division 45
Rural Development
Pilot Project Chemical Safety

Chemical Management Guide

Improve Chemical Management to Gain Cost Savings, Reduce Hazards and Improve Safety

Bonn 2002

The method of linking Risk Phrases (R-Phrases) with classification into hazard bands and the identification of needed control approaches described in Tool 1 of this Guide is based wholly on the approach of the ILO Safework Chemical Control Toolkit © 2001 produced by the Geneva-based International Labour Organisation working in collaboration with the International Occupational Hygiene Association (IOHA) and Health and Safety Executive (HSE) in the UK.

The integration of this approach into the Guide is gratefully acknowledged.

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Preface

This Guide will be of interest to companies that want to gain cost savings and reduce risks in the workplace. It is especially relevant for companies where chemicals represent a major portion of their running costs.

By improving the management of chemicals, companies can lower production costs, improve product quality, reduce their environmental impact, and improve the health & safety conditions for workers thereby increasing their motivation and productivity.

This Guide describes a step-by-step approach to identify and reduce costs and risks related to the use of chemicals. This approach is based on identifying „hot spots“ as a first step, and making a chemical inventory as a second step. These steps provide the needed information to observe and calculate potential losses, assess risks, consider substitutes (in terms of form and/or alternative substances), determine improvement measures and adequate controls, implement actions in a systematic way, and monitor and evaluate the results obtained.

The approach outlined in this Guide considers the specific operating conditions of companies in developing countries. It is intended to guide companies towards implementing a framework for effective and preventive Chemical Management, enabling enterprises to move in the direction of continuous improvement.

Activities undertaken to improve the management of chemicals will support companies in fulfilling government legislation related to chemical management. This Guide does not replace legal requirements. It is intended to help companies improve their practices with respect to chemical storage, handling, use, and labelling.

This Guide has been developed by the GTZ-Pilot Project for Chemical Safety in collaboration with ProduksiH, component of the Indonesian-German Environmental Programme (ProLH), and the German Federal Institute for Occupational Safety and Health (BAuA) and the Pilot Programme for the Promotion of Environmental Management in the Privete Sector of Developing Countries (P3U).

The concepts presented in this Guide have been implemented in small, medium, and larger-sized companies in the textile and leather sectors in Indonesia, as well as in an Indonesian company producing paint for the domestic market. These experiences provided insights into the obstacles that companies typically face in undertaking chemical management.

Success stories from the actual application of this Guide in Indonesian companies have been included to demonstrate the value and benefits for companies of improving chemical management.

Part I - How can you benefit by improving chemical management

1. Why should companies manage chemicals?

1.1 Benefit by reducing costs and environmental impact

1.2 Benefit by becoming more competitive

1.3 Benefit from improving health & safety

2. What does chemical management involve?

3. What stops companies from doing chemical management?

4. Taking a step-by-step approach to chemical management

1. Why should companies manage chemicals?

Of the 5-7 million known chemical substances, more than 80’000 are being used by companies in their production processes and operations. Over 1’000 new chemicals are discovered and produced each year. Today, almost every company uses some type of chemical. Those enterprises that effectively manage chemicals can gain concrete benefits.

1.1 Benefit by reducing costs and environmental impact

Chemicals can represent a major part of the production cost for companies. Any actions that can be taken to reduce the loss, waste, contamination, and expiry of these substances will bring cost savings to companies and at the same time, reduce their environmental impact.

1.2 Benefit by becoming more competitive

While chemicals are often used to achieve certain characteristics and qualities in a product — consumers do not want harmful chemicals put into the products they buy nor into the environment. Companies that avoid using banned and restricted substances can avoid having their products rejected in the marketplace.

Growing consumer consciousness of environmental and social issues has led to the creation of buyers' requirements that suppliers must increasingly fulfil to have their products accepted in many international markets. By identifying and reducing the use of banned chemicals and hazardous substances, companies can improve their competitive position and make the communities where their operations are located more safe.

Moreover, by improving the management of chemicals, companies that are working to achieve certification under environmental management standards (EMS) like ISO 9'000 and 14'000 will gain synergies. Many of the activities required for EMS certification are aimed at reducing the use of hazardous substances, protecting the health of workers, and reducing negative effects on the natural environment.

1.3 Benefit from improving worker health & safety

Chemicals alone or mixed with other substances can cause injury, disease, or even death for people handling these materials. The misuse of chemicals may result in fires and explosions. Accidents involving chemicals create additional costs for companies in terms of lost materials, damaged equipment and facilities, and personal injury. Reducing health and safety risks for employees improves their motivation and productivity and lessens absenteeism due to worker injury and illness.

2. What does chemical management involve?

To effectively manage chemicals, you need to:

- √ know the characteristics/properties of all chemical substances that are stored and in use in your enterprise,
- √ know the amounts of frequently used chemicals kept on hand,
- √ calculate the amounts of chemicals that are actually being used in production,
- √ evaluate the amounts of chemicals that are being contaminated, lost, wasted, and/or expired — and therefore no longer available for use,
- √ identify situations where hazards are present (*hazard means anything that has the potential to cause harm to people and/or the environment*),
- √ investigate whether alternative less hazardous substances/approaches can be used to achieve a similar effect in production and product quality,
- √ undertake measures to use chemical substances more efficiently and more safely,
- √ monitor the implementation of actions and undertake improvements on a continuous basis,
- √ measure the results achieved.

3. What stops companies from doing chemical management?

Companies that are operating in developing countries typically have limited financial and skilled human resources. Faced with a daily struggle for existence, their main focus is on producing and selling the end product. The idea of managing chemicals is often at the bottom of the list of organisational priorities.

What obstacles do companies face?

- Lack of information about the quality, quantity, characteristics, and hazards of chemical substances being used;
- low quality or inadequate characteristics of purchased chemicals to achieve the desired effect in production;
- poor labelling; unknown substances;
- limited financial and human resources;
- absence of systematic organisational procedures & documentation;
- lack of priority and responsibility given to managing chemicals.

Moreover, in family-run enterprises where expertise tends to be passed from one generation to the next - gaining access to the most current information about the proper storage, handling, use, and risks of chemicals is a challenge.

Due to these limitations, companies tend to take a reactive approach. Attention is often only put on managing chemicals after accidents or problems in the production process have occurred.

However, a preventive strategy can help avoid accidents and the significant costs related to such occurrences. A preventive approach helps companies to spot weaknesses and problems at an early stage. Any actions that companies can take to prevent problems in the first place will avoid the significant costs related to such occurrences.

The preventive approach to managing chemicals that is described in this Guide will help you identify opportunities to gain **cost savings**, **lessen the environmental impact** of your operation, and **reduce health risks** to which workers are exposed in daily operations.

4. Taking a step-by-step approach to chemical management

This Guide describes a step-by-step approach for achieving the economic and safe management of chemicals.

Step 1 - Identify 'hot spots'

This first step is meant to trigger thinking about chemical management.

It enables companies to quickly spot opportunities to:

- gain cost savings from more efficient storage, handling, use, and disposal of chemicals;
- identify especially hazardous situations where chemicals are being stored and used;
- determine the needed approaches to reduce the potential for harm;
- implement action, and monitor and evaluate the results achieved.

This step is appropriate for companies of any size where little attention, until now, has been put on managing chemicals.

Step 2 - Make a comprehensive inventory

This step helps companies get their whole house in order. It involves:

- systematically identifying all chemical substances stored and in use,
- creating a structured base of information (through the creation of a Chemical Inventory Table) that can be used to make improvements on a continuous basis.

This step is appropriate for companies that have already undertaken some basic actions to optimise the use of chemicals and address „hot spots“. It lays out a framework for companies to continuously reduce the use and risk of chemicals kept on hand.

Part II - Going into action

1. First step - Identifying ‘hot spots’

1.1 Doing a walk-through and making observations

1.2 Calculating losses, cost savings and assessing risks

1.3 Identifying improvement measures

1.4 Some ‘good practices’ for getting started

1.5 Creating a chemical management plan

1.6 What makes an action plan effective

☺ ***Success story from an Indonesian textile company***

2. Second step - Make a comprehensive inventory

2.1 Mapping out the chemicals in your company

2.2 Systematically improving chemical management

2.3 Doing adequate labelling

3. Third step - Making improvement continously

☺ ***Success story from an Indonesian tannery***

1. First step - Identifying ‘hot spots’

Companies that have put little attention on managing chemicals have told us that they need to see that they can achieve benefits in a short timeframe to be convinced that putting efforts into such an activity will be worthwhile.

For this reason, the identification of „hot spots“ can be a practical first step for improving chemical management in your operation.

„Hot spots“ are defined as:

√ Places where you can observe inefficient storage, handling, use, and disposal of chemicals — where improved practices could give cost savings.

√ Particularly hazardous situations where chemicals are being stored or used — where the potential harm could be reduced or prevented through the implementation of appropriate control measures.

To identify „hot spots“, **you need to look at your operations in a different way**. Rather than focusing on the end product, you need to look in a detailed way at the storage, handling, and use of chemicals in the production process.

Look specifically at how chemicals are being treated in steps involving their purchase, storage, handling, and processing with the aim of spotting inefficiencies, waste, losses, and risks.

The output of chemicals in products and their disposal in waste should also be considered. The inefficient use of materials often leads to an unnecessarily high level of chemicals (which are expensive to buy in the first place!) being used and ending up in final products and waste.

1.1 Doing a walk-through and making observations

To identify „hot spots“, we suggest that you do a walk-through of your entire operation, following the flow of chemicals through the different steps of purchasing, delivery, storage, handling, processing, and disposal (see **Figure 1**).

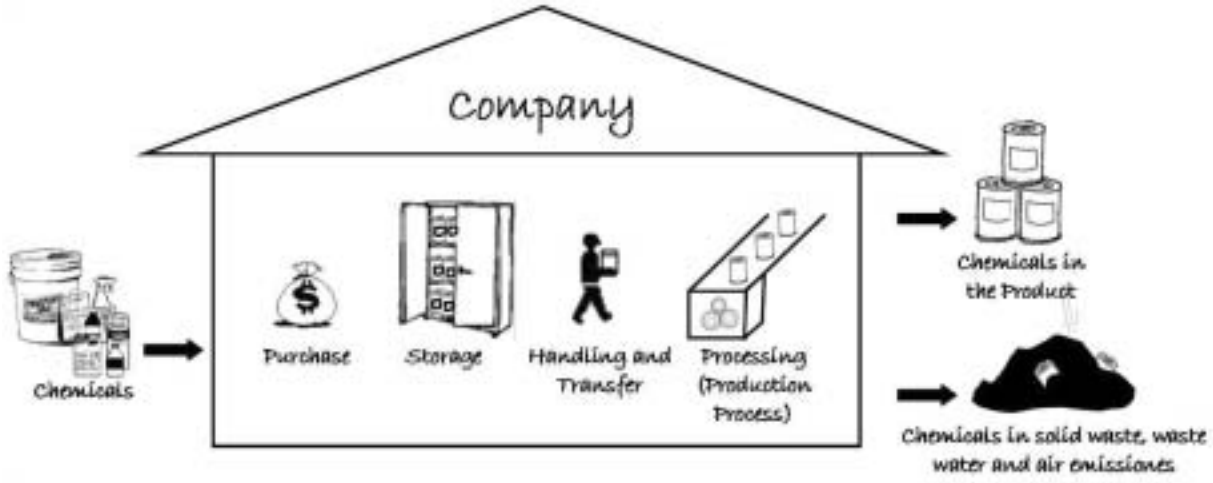


Figure 1: Simplified Flow of Chemicals in an Enterprise

Action 1:

Write down your observations in a work sheet (*in the form illustrated below*) noting down all situations where you see:

√ the waste, loss, contamination, or expiry of a substance;

√ potential hazards being created in the way that chemicals are being stored, mixed, transported, and used.

Create a work sheet

Area in Factory	Observations	
1. Delivery & Chemical Store	- the packaging of some calcium carbonate bags is damaged before and during their unloading into the chemical store	
2. Dye Kitchen	- spillage of dyestuffs around mass balance	

What should you look for during the walk-through?

To identify potential opportunities for cost savings and for reducing risks (i.e. „hot spots“) — as you walk around your operations — look for:

√ places where you see chemical substances spilled on the floor,

√ places where you see dust clouds being created during transferring or weighing operations,

√ lids that are not tightly sealed where the contents are being exposed to air, humidity, etc.

√ containers that are partially or completely uncovered where fumes are likely escaping,

√ chemical containers that are dented or damaged or defective,

√ chemical packaging that is deteriorating due to leakage, damage, floor water, humidity, etc.

√ containers that have no labels or where the labels are damaged,

√ chemical containers that are being used for other purposes e.g. storing water, storing and transferring other materials),

√ situations where workers have created and are using makeshift personal protection devices (e.g. towel wrapped around face),

√ places in the factory where workers complain about health effects, are knocked unconscious, etc.

√ incidents of fire, explosion, or accident in the past year.

1.2 Calculating losses, cost savings and assessing risks

Having written down your observations about inefficiencies, waste, losses, and hazards in all areas where chemicals are being stored and used, you now need to **assess the risks** — of losing money from the poor utilisation of chemicals, having lower product quality, having poor worker motivation and low productivity, and causing harm — **if you continue with present practices**.

Action 2:

Use the work sheet with your observations to determine losses and to evaluate the potential for cost savings and reducing risks (*see below*).

Area in Factory	Observations	Calculation of Losses and/or Hazards
1. Delivery & Chemical Store	- the packaging of some calcium carbonate bags is damaged before and during their unloading into the chemical store	- How much material (= costs) could be saved by changing procedures to minimise losses? - How much could product quality be improved by reducing chances that raw material has impurities or becomes contaminated?
2. Dye Kitchen	- spillage of dyestuffs around mass balance	- How much material (= costs) could be saved by avoiding accidental mixtures?
3. Production area	- storage of flammable liquids by machines - solvent containers where the lids are off - spillage of materials during mixing	- Is the use of this substance causing serious harm for human health or the environment? Can this potential harm be minimised or even prevented entirely by changing the form of the substance or using alternatives?

Go through each of your observations, asking yourself these questions:

- What quantity of a particular chemical substance is actually needed for the production process?
  - Do you have any recipes, specifications, or guidance from suppliers that provides this information?
- What quantity of substances are actually being used?
  - Do you have records that you can use to accurately verify the amounts of substances received and withdrawn from your stock?
  - Can you observe transfer & handling processes and measure exactly what amounts are being used?

  - If not, can you make assumptions about amounts of substances actually being used in your production process?
  - Are the amounts of chemicals actually being used more than the amounts specified in your recipes, specifications?

- Why are some quantities being wasted or lost?
  - Can you identify the causes for losses of chemicals during delivery and in your storage area?
  - Can you observe any practices or activities that are leading to losses during handling and weighing operations?
  - Do you ensure that only the needed quantity of chemicals is pre-mixed?
  - Do you make sure that the appropriate quantity and mixtures of chemicals are used in the production process?
  - Do you know the expiry dates of all chemicals kept on hand?
  - Do you use materials first which you bought first (first in - first out)?

- How much material (= costs) is being lost due to accidents?
  - Do you have records for worker injury/accident in order to know the frequency of such occurrences?
  - Is material being lost due to poor labelling and accidental mixtures?

- Could product quality be enhanced by avoiding situations

where raw material has impurities or becomes contaminated on site?

- Is a substance causing serious harm for human health or the environment? Can this harm be minimised or even prevented entirely by changing the form of the substance or by using less hazardous alternatives?

To answer these questions, refer to **Tool 1** which provides guidance for assessing the risks of chemical substances.

Tool 2 outlines measures to reduce or prevent these risks.

1.3 Identifying improvement measures

Having analysed your observations and found that chemicals are indeed being lost, wasted, contaminated, expired and/or are causing harm to human health or the environment — you now need to think about actions that can be undertaken to **reduce losses** and **reduce potential harm**.

Action 3:

Formulate corrective measures by asking yourself the following questions about observations you made during the walk-through:

- Could you change working practices or procedures?
- Could you make repairs (to floors, roofs, etc.) to avoid contamination, accidents, and losses?
- Can you improve storage conditions?
- Can you establish a stock control system in order to strictly monitor and record the receipt and withdrawal of chemicals?

- Can you keep only the amounts of chemicals in the production area that are needed for daily use?
- Can you provide more suitable tools to facilitate the transfer of chemicals and avoid losses?
- Can you ensure that transfer containers are dedicated for use in handling a single substance to avoid contamination?
- Have you provided sufficient ventilation to reduce the concentration of mist, vapours, gases, and dust in the air?

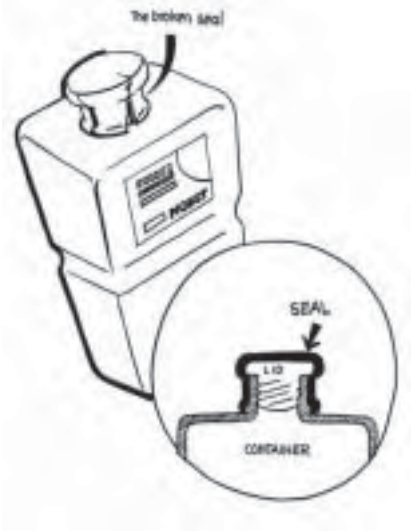
The following pages illustrate some **„good practices“**, which you should be sure to include within your first set of improvement measures.

1.4 Some „good practices“ for getting started

√ Repair all broken seals to avoid that vapours are escaping.

√ Make sure that the packaging of materials is not damaged during delivery and storage.

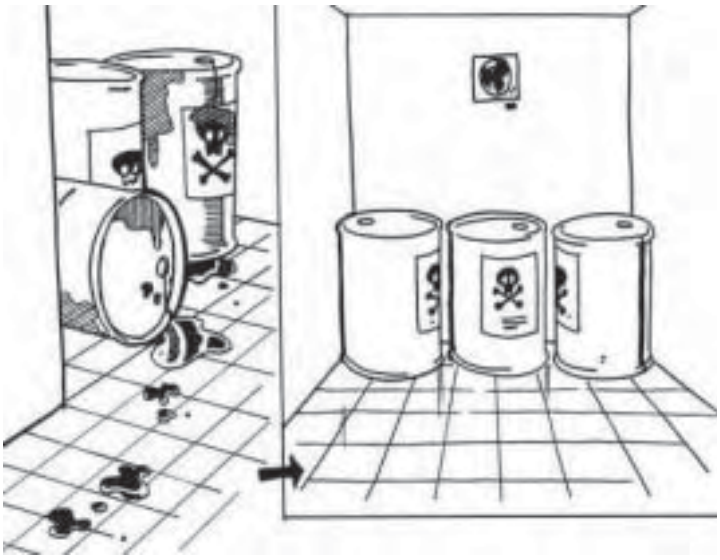
√ Return poorly packaged or deteriorated materials to suppliers.



√ Regularly inspect and keep the storage area clean to avoid any contamination of materials.

√ Store containers with hazardous chemicals on catchpits to contain any accidental spillage.

√ Place chemical drums on an elevated rack and insert a metal or plastic spout to safely transfer materials to smaller containers.



√ Immediately clean up any spillage to prevent accidental mixtures that could lead to ignition or explosion.

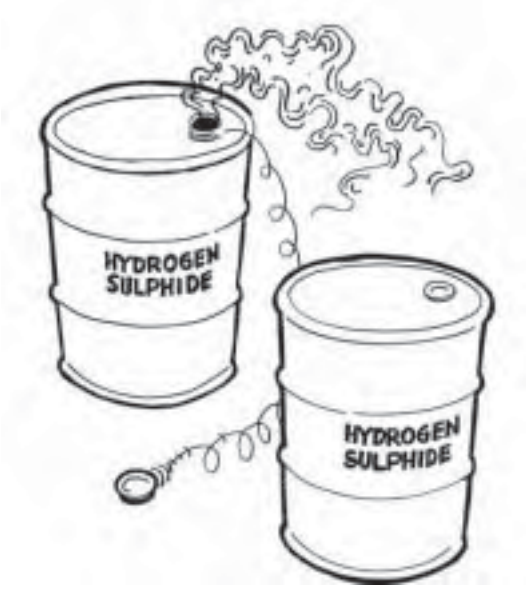
√ Provide sufficient ventilation to keep humidity, temperature, and the concentration of fumes & vapours at a low level.

√ Ensure that the floor where chemicals are stored is made of non-permeable material (e.g. cement, concrete) to prevent the contamination of soil and groundwater in case of spillage.

√ Limit and control access to the storage area in order to monitor the reception and withdrawal of chemicals.

√ Ensure that the lids of all chemical containers are tightly closed.

√ Stock chemicals in compatible groups to avoid the possibility that vapours could react together and lead to fire/explosion.



Provide appropriate personal protection equipment

Use granular forms instead of fine powders to reduce 'dustiness'

√ Ensure that flammable substances (e.g. organic solvents) are not exposed to direct sunlight that avoid self-inflammation.

√ Store chemicals in designated areas physically separated from production areas & workshops that contain sources of ignition (e.g. generators, transformers, equipment).

√ Provide appropriate personal protection equipment to workers and instruct them in its proper use, storage, and maintenance.

√ Instruct workers to avoid using the same tools (e.g. cups, scoops, buckets) for measuring and removing materials to avoid contaminating stored chemicals.

√ Transfer chemicals in a closed system to avoid the distribution of vapours, spillage, and accident.

√ Provide carts, trolleys, and other simple transport devices to move materials to avoid accident and spillage that can easily occur during manual carrying.

√ Post warning signs describing precautionary measures in areas where hazardous chemicals are being handled.

1.5 Creating a chemical management action plan

To ensure that the improvement measures you identified are actually implemented and that you achieve the anticipated benefits, it is important to have some type of documentation and a process to be followed.

In this respect, we suggest that you create a chemical management action plan. This allows you to document the observations that you made during the walk-through and to translate the results of your analysis about potential cost savings and reduction of risks into concrete actions, where individuals are given responsibilities to implement needed activities or modify processes within a given time horizon.

Action 4:

Create a chemical management action plan, which contains the following elements:

Area	Specifies the area in your factory where you made a particular observation.
Observations	Describes the „hot spots“ you identified; refer to the notes you made during the walk-through.
Objective	Indicates the anticipated improvement or benefit in terms of optimising chemical use, reducing health risks for workers, reducing environmental damage, improving product quality, etc.

Proposed actions	Lays out specific activities to be undertaken in order to achieve the improvement or benefit being sought
Responsibility	Indicates the person who is responsible for taking action and monitoring the results
Timeframe	Specifies the time period within which action should be completed
Results	Indicates the eventual benefits achieved vis-à-vis cost savings, risk reduction, improved competitiveness, etc.

An action plan based on the implementation of chemical management in an Indonesian textile company is contained on the next page.

Chemical Management Action Plan						
Area	**Observations**	**Objective**	**Proposed Actions**	**Responsible**	**Timeframe**	**Results**
Dye kitchen	•A dyestuff being used by the company is anazo-dye preparation according to the Material Safety Data Sheet (MSDS) provided by the chemical supplier	Avoid that products are rejected by customers in international markets	•Ask the chemical supplier to provide a certificate confirming that the dyestuff does not contain components that are banned or restricted for use under international eco-criteria •Alternatively, ask a local lab to determine if certain amines are present •Investigate alternatives (look for other dyestuffs with same colour index #)	Purchasing Manager	Within 1 month	Gained reputation as a high quality supplier; received additional orders from international buyers
Laboratory	•Over-use & loss of dyestuffs during sampling process •Using high pressure water hose to clean dyes off of screens	Capture waste dyestuffs for reuse Prevent contamination of river and surrounding soils	•Purchase a rubber spatula ($US1) •Instruct workers to use this to clean waste dye off screens into a bucket instead of washing the material into the drainage system •Place waste dye in a 20L container; empty each week and use in production process (mix to make black) •Ensure waste water goes to sewage treatment not discharged into the river	Laboratory Supervisor	Within 2 weeks	Cost savings from reuse of dye samples
Engraving Department	•Spillage of chromic acid on the floor; this material is a concentrated acid that is corrosive & dangerous	Reduce the hazard level for workers handling this substance Avoid contamination of ground water and soil	•Provide workers with corrosive resistant gloves & eye protection; inform of risks •Capture chromic acid for reuse in cleaning activities •Investigate alternative cleaning solutions (e.g. non-hazardous detergents)	Production Manager	Within 1 month	Now using a neutralisable cleaning solution to achieve same effect
Dyestuff storage	•Large inventory of chemicals for cotton production not used in past 3 years	Liberate capital for other uses Avoid waste/expiry of substances	•Sell chemicals to small, nearby firms who are working with cotton fabrics •Move dyestuffs sitting in production area into this secure storage area	Purchasing Manager & Production Manager	Within 3 months	Recovered $US 5'000 in inventory costs

Figure 2: Chemical management action plan resulting from the application of chemical management in an Indonesian textile company

1.6 What makes an action plan effective?

The creation of a chemical management action plan establishes the basis for implementing measures, making improvements, and evaluating the results achieved.

To develop and implement an **effective action plan**, be sure to:

- √ Consult the people who are directly involved in handling chemicals about proposed actions in order to understand the implications for changing procedures.
- √ Investigate how unintended consequences of any proposed action can be avoided or mitigated.
- √ Set ambitious but achievable objectives.
- √ Check that the proposed actions are sufficient to meet the stated objectives.
- √ Verify that actions to be undertaken are clearly understood by those who are making the changes.
- √ Give the responsibility for taking action to specific individuals. If no individual is responsible, nothing will happen!
- √ Make sure that those designated as responsible have the needed expertise and authority to carry out the proposed action.
- √ Be specific about who must do what, in which different way, etc.
- √ Establish a realistic timeframe for who should do what by when.

√ Make sure that all workers affected by changes in the current way of doing things are informed and trained in new procedures.

√ Give workers incentives (e.g. monetary reward or other schemes) for reducing the waste of chemicals.

√ Check the progress that was achieved by the deadlines that were set.

√ Measure the results achieved concerning:

- cost savings,
- reduced harm and improved safety standard for workers,
- improvement in product quality and competitiveness.

√ Determine if additional improvement measures are needed to meet the desired objectives.

Success story from an Indonesian textile company

Meeting international eco-criteria to expand market opportunities

Established in 1978, this family-run company employs 185 people who work on three 8-hour shifts around-the-clock. The company acts as a „job shop", doing dyeing and printing of polyester fabrics for other Indonesian companies. The final products are destined for both the local market and for export. The company wants to create a reputation of being a high quality supplier. Management believes this will increase the interest of international buyers in its products.

„Hot Spot" in the dye kitchen

One of the company's important customers specified the use of a particular dyestuff for its orders. The company liked the effect of this dyestuff in production and began using it in large quantities. In using this Guide to identify „hot spots", it was discovered that this dyestuff is an azo-dye preparation, according to the Material Safety Data Sheet (MSDS) provided by the chemical supplier. Certain azo-dyes are carcinogenic and therefore present a serious health risk to humans. The company was informed that the use of certain azo-dyes can lead to its products being rejected by international buyers because the fabric does not fulfill eco-criteria set out under various label schemes. Inter-

national standards like Öko-tex 100 — which specify parameters that can be tested on the final product — have been created to assure customers that textiles are free of harmful substances.

Actions taken by company

After consulting with the chemical supplier, the company determined that banned amines were present and could be detected in the final product. The company initiated a discussion with the customer that specified the use of this dyestuff and informed them about the risks of continued use (i.e. the risk that international buyers of its garments could reject shipments). The company investigated and found an alternative dyestuff with the same generic colour index number. This substance provided an almost equivalent effect in production and was not a restricted azo-dye.

Result

By showing that it is aware of the chemicals being used and the implications down the whole value chain, the company's reputation as a high quality supplier increased in the eyes of its direct customer. Within 6 months, word had spread and the company began receiving additional orders for fabrics destined for the export market.

2. Second step - Make a comprehensive inventory

Having undertaken a set of basic actions to address „hot spots“ and optimise the use of chemicals, companies have an opportunity to gain further benefits from improved chemical management by getting their whole house in order.

This second step of chemical management involves:

- systematically identifying all chemical substances that are stored and in use in the factory
- creating a structured base of information that can be used to identify and make improvements on a continuous basis.

What is the benefit of doing such an inventory?

If chemical substances can be identified in a precise and complete manner, then the whole operating context and production of products can be considered and improved by undertaking targeted measures to reduce chemical use and risks throughout your operation.

By making a comprehensive inventory of all chemicals on hand, you will be able to:

√ identify redundant products (i.e. chemicals being used for the same purpose); less material is wasted/lost by having fewer containers open at the same time with their contents being used for essentially the same purpose;

√ identify unknown substances, which can then be used before they expire, or they can be properly disposed of;

√ reduce losses due to the expiry of stored substances;

- √ improve product quality by investigating chemical properties, becoming aware of inherent impurities, contamination on site, etc.;
- √ enhance competitiveness by becoming aware of the use of banned or restricted chemicals that customers in international markets will not accept;
- √ avoid rejection of your products because of failure to meet certain buyer requirements (which often specify chemicals that can not be used for their customers);
- √ discuss with suppliers the possibility to provide substances in a less hazardous form (e.g. granular forms are less hazardous than fine powders; refer to **Tool 1**);
- √ discuss with suppliers the possibility to provide chemicals/preparations with higher boiling points (a substance with a higher boiling point is less volatile than one with a lower boiling point; but beware of substituting chemicals that, although less volatile, have a higher hazard rating; see **Tool 1**);
- √ investigate with chemical suppliers what kind of substitutes are available for particularly hazardous substances
- √ consider how to modify working practices to reduce the potential harm for those involved in handling certain substances;
- √ avoid accidents, fire, explosion from incompatible materials stored together or mixed inappropriately;
- √ support work towards implementing management standards, like ISO 14'000, etc.

Once a comprehensive chemical inventory is completed, this can be used as a benchmark for making improvements on a continuous basis.

2.1 Mapping out the chemicals in your company

To create a chemical inventory, first investigate what information already exists within the company regarding chemicals (e.g. purchasing records, stock control cards, etc.). This documentation provides a good place to start. It gives you some indication of the type and amounts of chemicals on hand.

If this information is not up-to-date or sufficient to give you an accurate picture of all chemicals that are on the premises and how they are being used, we suggest that you do a physical mapping out of chemicals — going systematically department by department - using the following methodology.

Action 1: Draw out a simple ground plan of the company - you can also use an existing floor plan of the company

Action 2: Mark where chemical substances are being stored and/or used

Action 3: Specify chemical substances in an inventory table

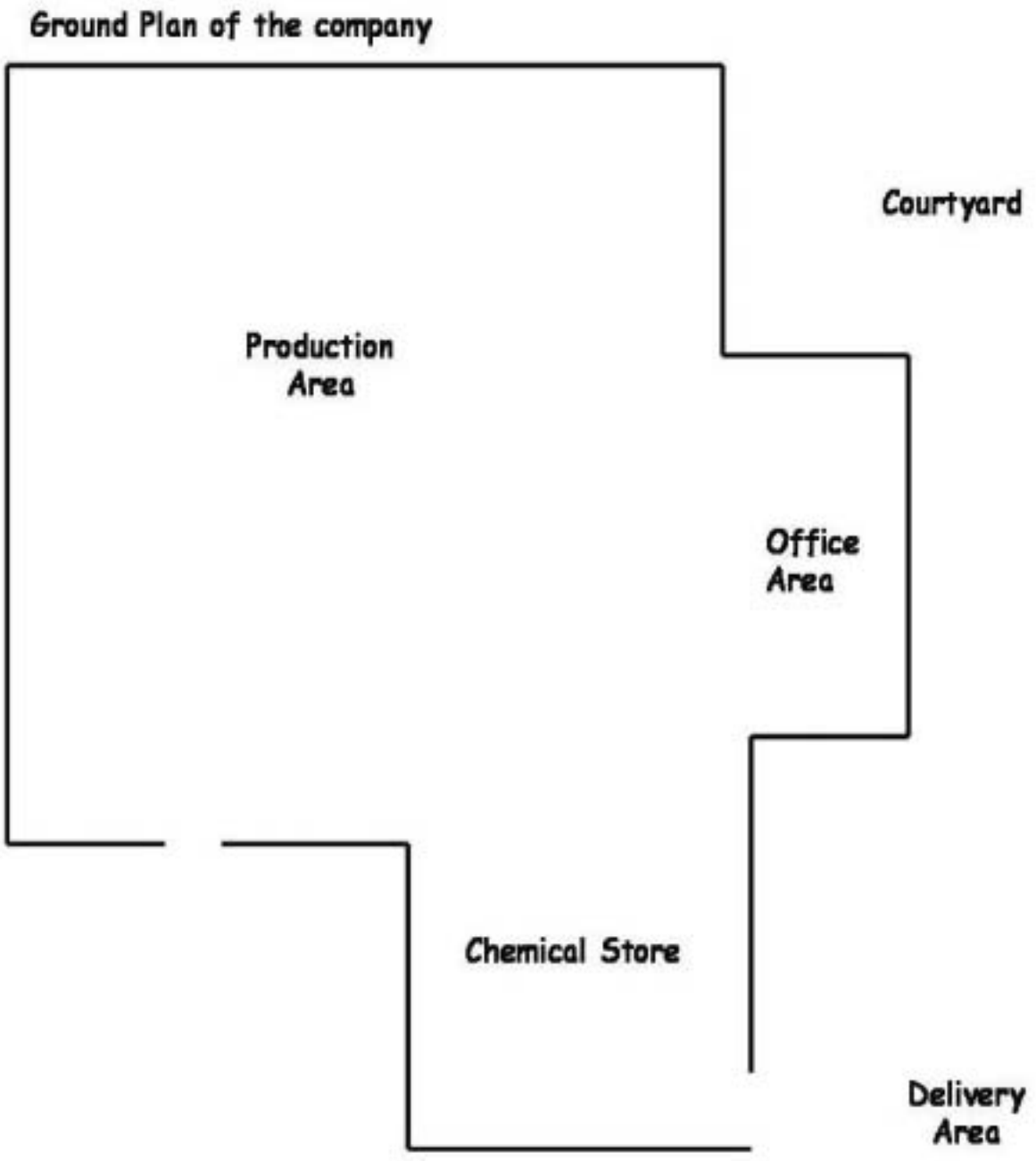
Be aware that chemicals are:

- Used as raw material inputs in the production process,
- individual substances or mixtures (preparations),
- released as vapours during the handling of preparations or products,
- generated during work activities (e.g. dusts, fumes from welding),
- used as auxiliaries (e.g. fats, liquors, dyes, paints, adhesives),
- used for other purposes, like cleaning workplaces and maintaining machinery (e.g. detergents, disinfectants, solvents, greases),
- found in final products (e.g. leather, textiles, panels, bricks, etc.).

Action 1: Draw out a ground plan

1. Draw a simple ground plan of the company

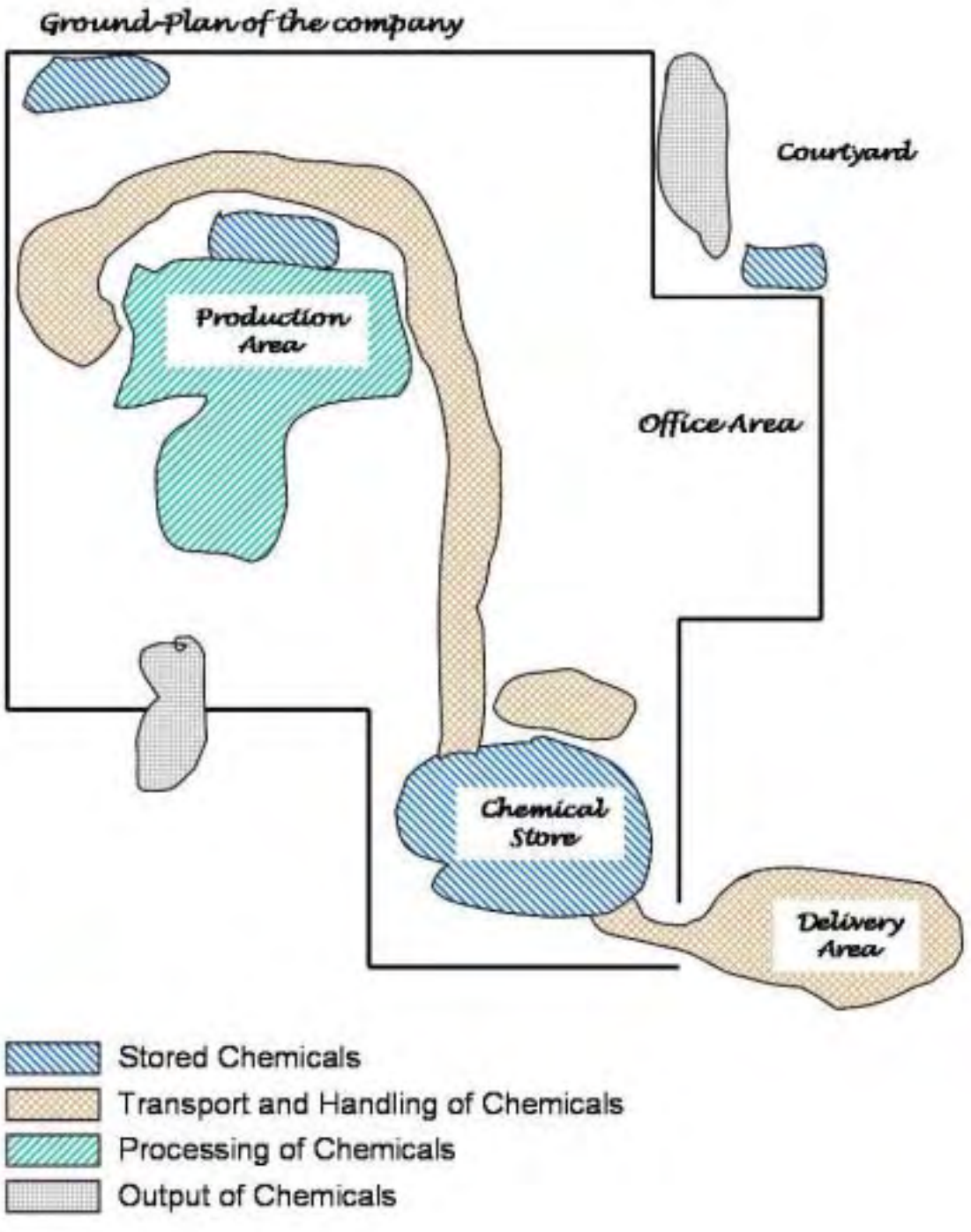
2. Note the main areas and departments



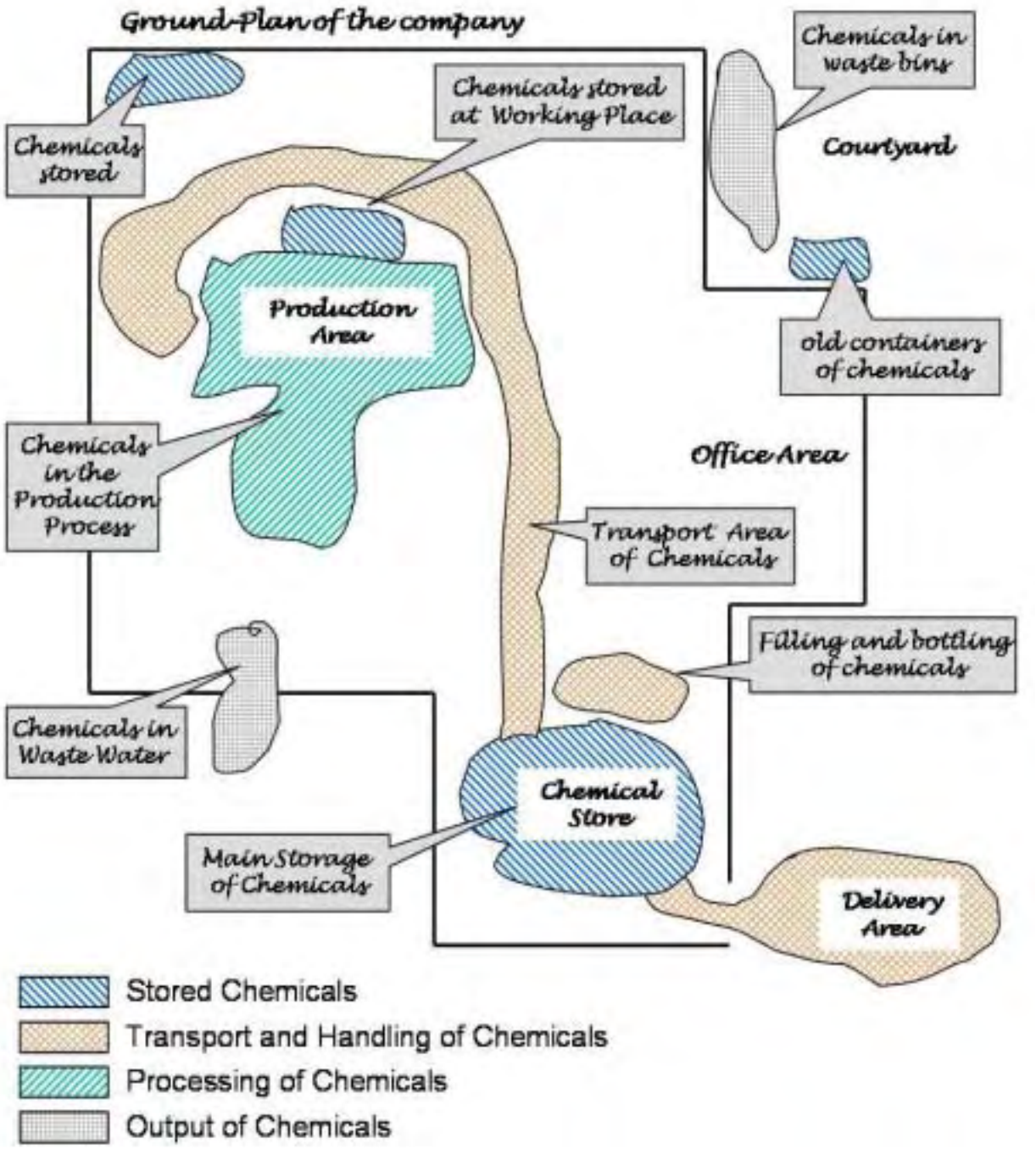
Action 2: Mark where chemiclas are being stored or used

1. Mark the areas where chemicals frequently occur.

2. Use different colours to highlight the different processes: Storage, transfer & handling, production process, outputs (products and waste). *Refer to the legend at the bottom of this page.*



3. Specify where chemicals occur within the marked areas.



Action 3: Document chemicals in an inventory table

1. List the chemicals that you have identified in an inventory table (see **Figure 3**).

2. Begin with one department and proceed on an step-by-step basis until you have a complete inventory for your whole operation. This process can be completed over a period of time (e.g. 2 weeks).

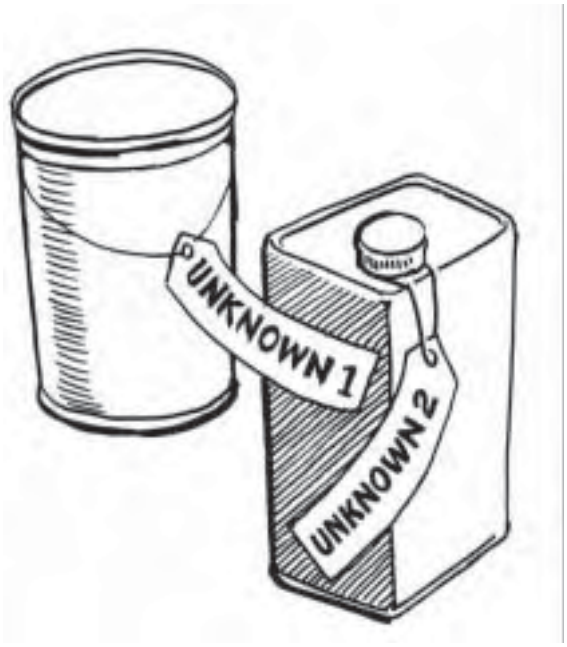
The inventory table should include the following information:

- √ trade name, chemical name, physical form;
- √ amount actually kept on hand;
- √ scale of use in production (e.g. per week, month);
- √ information regarding risk/hazard level from label on container or from Material Safety Data Sheet (MSDS) provided by chemical supplier;
- √ notes about handling, use, storage conditions.

Chemical Inventory Table					
Area in Factory	**Name**	**Amount on hand**	**Scale of Use g/kg/ton ml / l / m3**	**R-Phrase & Hazard Band Safety Information**	**Notes about handling, use, storage**
Chemicals in the stocking area					
Chemicals being transferred & handled					
Chemicals involved in the production process					
Chemicals stored in places other than the stocking area					
Chemicals in the solid waste					
Chemicals in the waste water					
Chemicals in the air (emissions)					

Figure 3: Chemical inventory table

What about unknown substances?



For substances that can not be immediately identified, assign them a name (e.g. Unknown 1, Unknown 2) in the inventory table and be sure to specify their physical location within the factory.

Write this assigned name down on a tag and attach it to the chemical container in the factory to allow follow-up at a later stage.

Figure 4 (refer to next page) contains an extract from the inventory table that was created during the implementation of this Guide in an Indonesian tannery.

Most of the tannery's chemicals are stored within the actual production area and could be identified either from the label or by asking the workers who handle these substances on a daily basis.

Working from an existing floor plan for the factory, the location of chemicals stored throughout the premises was mapped out.

The amounts of chemicals kept on hand was physically counted and listed in the inventory table, together with information gathered from various sources (e.g. label, Material Data Safety Sheet) about the risk/hazard level and recommended conditions for adequate storage, handling, and use.

Chemiclas stored in soaking department (dyestuffs, retanning stock)

#	MSDS (✓)	Chemical Name	Amount on hand (physically counted)	Scale of use	R-phrase, hazard band safety information	Notes about handling, use, storage conditions
1		Oxalic acid	25 x 25kg		R21/22 = Hazard Band B S24, 25	Store in a dry cool place in tightly closed container; should have eyewash facility and safety shower in area of use; should be handled in a chemical fume hood; eye goggles, protective gloves, chemical apron should be used
2		BasoZym	9 x 25kg			
3		Intan CF	9 x 20kg			
4		Sodium acetate	34 x 25kg			
5		Unknown 1	4 containers			
6		Coratyl D	30 x 25kg			
7		Unknown 2	6 x 20kg			
8		Triton B	30 x 25kg			
9		Syenktan F	12 x 25kg, fine powder			
10		Synektan Ran	15 x 25kg, fine powder			
11		Sodium bicarbonate (baking soda)	39 x 25kg		Causes mild irritation to eyes, skin, respiratory tract	Store in a dry cool place in tightly closed container. Be sure to store with compatible substances. Adequate ventilation is required for handling
12		Magnesium sulphate	16 x 25kg		S24/25 Avoid contact with eyes & skin	Store in a dry cool place in tightly closed container; adequate ventilation is required for handling
13		Sodium formate	3 x 25kg			Packaged in paper sacks, covered in plastic on pallets but deteriorating due to leaky roof
14		Santan 7RS	30 x 25kg, fine powder			
15		Intan 275	10 x 25kg, fine powder		R20/21/22; 36/38; 40; 45 S26; 36 = Hazard Band D	Harmful if in contact with skin; irreversible health effects are possible; may cause cancer
16		Conastel yellow			R37 = irritating to respiratory system; R41 = causes serious damage to eyes; R38, 43, 20/21 = irritating to skin	
17		Mimosa dye		3-4kgs/day		Bag is often open for 1-eek exposed to air and deteriorating
18		Sodium tetraborate (borax)			Causes irritation to eyes & skin, respiratory system; can cause lung damage	store in cool dry place in tightly closed container; eye wash facility should be available in area of use; use gloves and chemical apron for handling

Figure 4: Extract from the chemical inventory table of an Indonesian tannery

Chemicals in finishing store

#	MSDS (✓)	Chemical Name	Amount on hand (physically counted)	Scale of use	R-phrase, hazard band safety information	Notes about handling, use, storage conditions
127		B1-1	26 x 25kg		irritating to skin & eyes	
128		Clear lacquer	18 x 23kg		don't breathe in vapour	flammable
129		UN 1263 Icalc SFL	many 100kg containers		irritating to skin & eyes R11, 20, 62,62 S16, 23, 25, 29, 38	flammable
130		SL 662	7 x 40kg			flammable
131		Icapoil	2 containers		R34, 38 S23, 38	
132		Icacril	3 containers		R34, 38 S23, 28	
133		Kaport (calcium hypochlorite) (disinfectant for waste water treatment)	11 containers		R8-31-34 oxidiser & corrosive	
134		Leather pigment XBS	10 x 60kg			heavy wooden slats stored on top of containers
135		SP-34-076	100kg containers			
		many more unknown dyestuffs				
		many unlabelled plastic containers stored at wall in water treatment area				

Figure 4a: Many more chemicals are listed in inventory table in other departments around the factory

2.2 Systematically improving chemical management

Having listed all chemical substances kept on hand in a precise and complete manner, you are now in a position to consider how your whole operating context and production process could be improved. To evaluate the potential for cost savings and reducing risks, consider each chemical in your inventory list, asking yourself these questions:

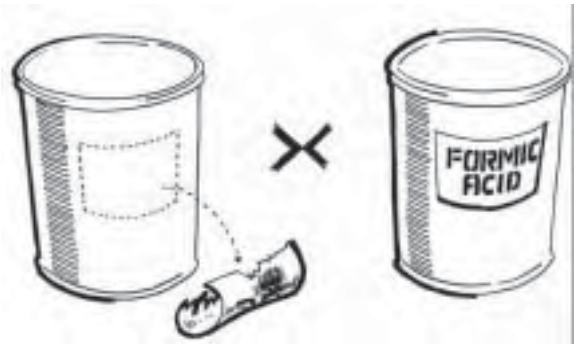
- What quantity of the substance is needed for the production process?
- What quantity of the substance is actually being used?
- Why are some quantities being wasted or lost?
- Can a smaller quantity of this substance be kept in stock?
- Can a different handling approach be used to reduce spillage, waste?
- Could an alternative substance be used (is this chemical redundant)?
- Is this substance banned or restricted for use according to any eco-criteria or national or international legislation?
- Can a different form of this substance (e.g. granular or liquid instead of fine powder) be used that is less dangerous?

Use **Tool 1** to determine if the use of a particular chemical creates unacceptable risks for your company. **Tool 2** describes the control measures that can be undertaken to reduce the potential for harm.

Put the results of your analysis and proposed actions into an action plan (use the same process described and illustrated on pages 22-23 of this Guide). In your action plan, be sure to:

- assign responsibilities to individuals,
- be specific about who must do what, in which different ways,
- establish realistic timeframes for who should do what by when,
- check the progress that was achieved by those deadlines, and take remedial action as needed,
- measure the results achieved!

2.3 Doing adequate labelling



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

- The purpose of a label is to inform anyone handling the chemical substance about its hazards and suitable precautions. The main elements of an adequate label are illustrated in **Figure 5** (refer to next page).
- Labels containing the chemical name, R-Phrase, and S-Phrase should be affixed to the package or container for all chemical substances that are stored, in either temporary or permanent locations to allow for easy identification and to prevent accidental mixtures.

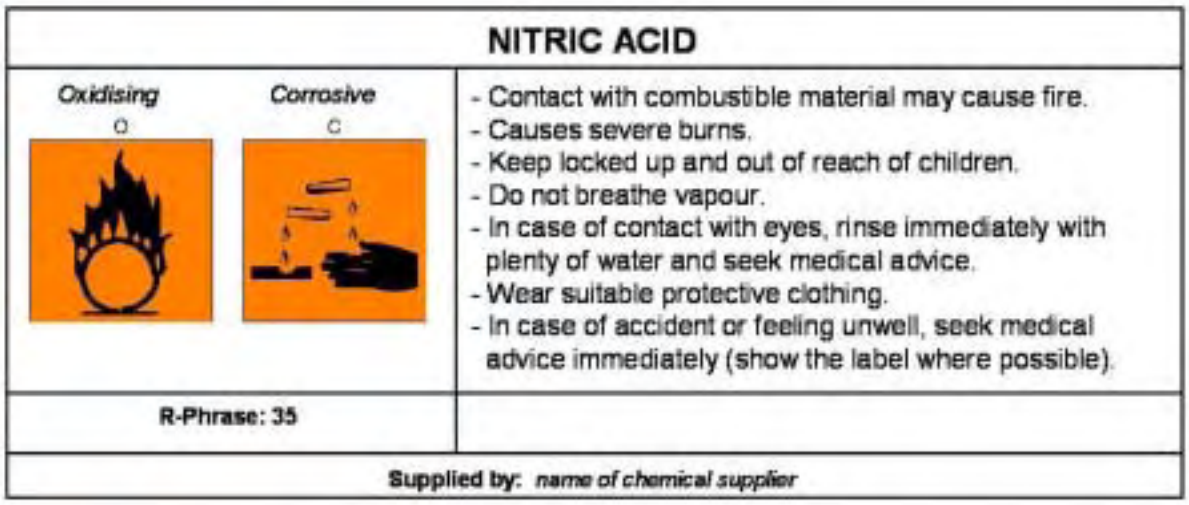


Figure 5: Elements of a proper label[1]

- **Tool 6** contains symbols that are commonly used in labelling hazardous substances.
- **Tool 4** and **Tool 5** contain risk phrases (R-Phrases) and safety phrases (S-Phrases) and their meanings, which are also useful to include on product labels.
- This information is also normally found on Material Safety Data Sheets provided by chemical suppliers (a example of an MSDS is contained in **Tool 3**).

1 Adapted from The Complete Idiot's Guide to CHIP, Chemical Hazard Information and Packaging for Supply, (1999). Suffolk: Health and Safety Executive

3. Third step - Making improvement continously

A company will only obtain the benefits of chemical management by successfully undertaking action. Proposed actions need to be regularly monitored to identify and remove the obstacles to implementation.

Chemical management is a process of continuous improvement. Once initial goals are met, new goals need to be set and worked towards. Results need to be evaluated on a systematic basis in order evaluate the benefits achieved, and remedial actions need to be put in place where the anticipated benefits have not yet been fully realised.

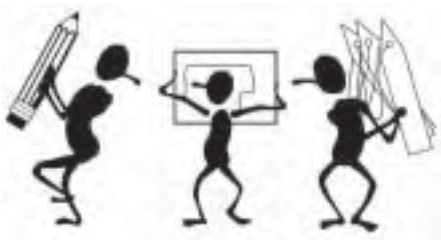
To create a system of <u>continuous improvement</u>, you need to:

√ Evaluate the actions undertaken to determine if the set objectives were achieved;

√ communicate and reward results;

√ monitor results to ensure that improvements are maintained;

√ establish new targets and areas for action in order to make further improvements in the company's operations.



Our main advice for getting started on chemical management and achieving concrete benefits is

just do it!

Success story from an Indonesian tannery

Chemical Inventory gives clues for reducing production cost

Established in 1951, this company employs 60 people to process locally-purchased cow hides into leather that is sold to other Indonesian companies for making shoe uppers. The company estimates that chemicals represent 25-40% of its cost of production. Since the economic crisis, most of its dyestuffs are purchased from international suppliers through local distributors and must be paid for in US dollars. As the price for raw hides is also increasing, the company is under a lot of pressure to still make a profit.

Cataloguing the storage & use of chemicals

After completing the chemical inventory, management was surprised to learn that more than 130 different chemicals were being kept on hand. Additionally, there were a large number of unknown substances. While visually inspecting the chemicals — which were mostly stored in the production area — the Production Manager (one of the owners) realised that many materials, especially expensive dyestuffs, were deteriorating in the hot, humid conditions of the beamhouse. During the rainy season, the leaky roof and flooding in the factory were further contaminating stored materials.

Actions taken by company

A central storage area was created near the office. This required the construction of two walls to enclose the space. There was already a cement floor and some natural ventilation due to an open-bricked top. All dyestuffs and powdery substances were then moved into this area, and access was restricted. A stock room manager was appointed and given responsibility for recording the receipt and withdrawal of all materials.

Result

By calculating the theoretical cost (based on recipes) of its processes – soaking/liming, tanning, retanning, finishing — and comparing this to the amount of chemicals actually being used in production, the company discovered the extent of chemicals being lost, wasted, and over-used. By tracking the amounts of chemicals actually being used versus the amounts specified in recipes, and identifying the causes of these variances on a daily basis, the company succeeded in reducing its chemical costs by 5% within one year. For the soaking/liming process alone, this reduction in chemical use (from reducing loss waste, loss, etc.) represented savings of $US 3'100 each week!

Part III - Tools to help you achieve steps 1 and 2

Tool 1 - Basic concepts for doing risk assessment

Tool 2 - Description of control approaches

Tool 3 - Using Material Safety Data Sheets (MSDS)

Tool 4 - Risk Phrases (R-Phrases) for hazardous substances

Tool 5 - Safety Phrases (S-Phrases) for hazardous substances

Tool 6 - Symbols used for labelling hazardous substances

Tool 1 - Basic concepts for doing risk assessment

To improve the management of chemicals, it is important to understand some basic concepts and sources of information for doing risk assessment.

In simple terms, risk assessment means carrying out a careful examination of the substances and situations in the workplace that could cause harm to workers and/or the environment.

Why do a risk assessment?

Such an investigation provides the basis for determining which precautions can be taken to ensure that no one gets hurt or becomes sick from handling chemicals in the workplace.

Many materials are purchased by companies for use in the production process (e.g. dyes, pigments, inks, coatings, fuels, varnishes, degreasing solvents, cleaning products, pesticides, fungicides, etc.). If not handled correctly, these types of substances and preparations (which contain chemicals) could cause harm.

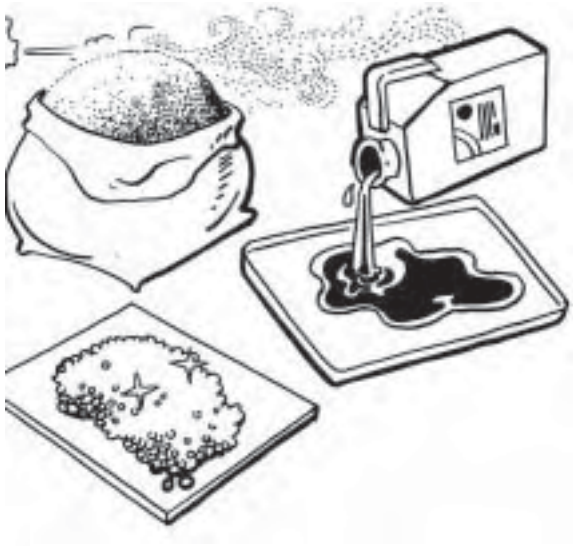
In addition to significantly affecting the lives and livelihoods of workers, accidents and poor health can negatively affect the company; for example: lowered productivity, loss of motivation, increased insurance costs, poor quality of final products, damaged machinery, loss of materials, etc.

What are hazard and risk?

- „Hazard“ means anything that can cause harm to people and/or the environment.
- „Risk“ is the probability (high or low) that human health, property, or the environment will actually be harmed.

The probability of harm occurring is influenced by several factors:

1. Toxicity of the chemical.



2. The chemical’s physical and chemical properties.

3. Type & extent of exposure to the substance (e.g. inhalation of gases, vapours, or airborne particles; absorption through skin; ingestion by mouth, splashing of eyes, etc.).

R-Phrases and the link with Material Safety Data Sheets (MSDS)

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).

Many R-Phrases refer to health effects on humans (e.g. R34 means that the chemical „causes burns“). Other phrases describe environmental effects (e.g. R11 means that a substance is highly flammable). S-Phrases give guidance for the safe handling of dangerous chemical substances and preparations (e.g. S24 means „avoid contact with skin“).

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 can have both effects of being „irritating to eyes“ and „irritating to respiratory system“.

Tool 4 lists commonly-used R-Phrases and their meanings.

Tool 5 lists commonly-used S-Phrases and their meanings.

Where are R-Phrases found?

These phrases are normally contained on the product label and on the Material Safety Data Sheet (MSDS) that should be provided by the supplier of any chemical that is considered to be hazardous for human health and/or the environment (see **Figure 6 and Figure 6a**).

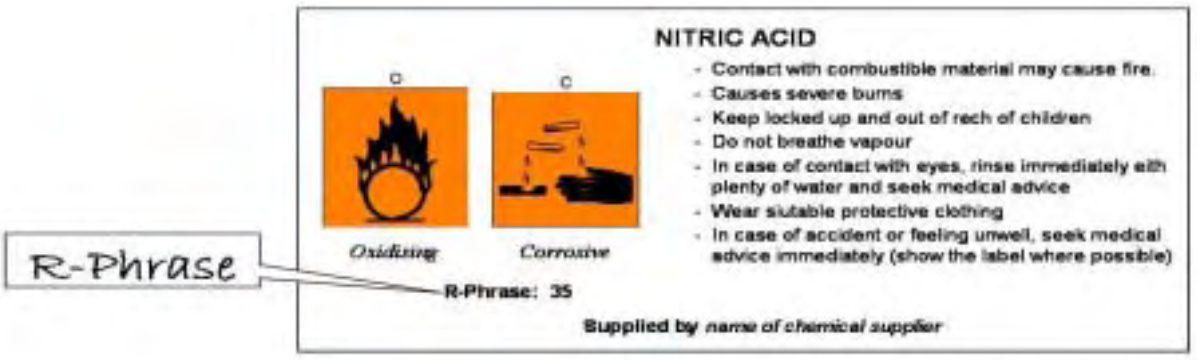


Figure 6 : Locating the R-Phrase on a Product Label

Figure 6a : Locating the R-Phrase on an MSDS

Tool 3 describes the uses of a Material Safety Data Sheet (MSDS) and contains the entire MSDS for sodium sulfide, as an example.

R-Phrases, MSDS, and the link with hazard bands[1]

Different substances can cause harm in different ways. Some chemicals are more hazardous and can cause more harm than others. Some substances cause only minor irritation of the skin, while others can cause severe burns, can greatly damage the respiratory system, and even result in death. Some effects on health appear immediately (e.g. cyanide poisoning) while others may only be apparent after several years (e.g. lung cancer caused by asbestos).

Chemical substances that have the potential to cause more serious harm require a greater level of control than less harmful substances — to avoid that people and/or the environment are seriously harmed.

Distinguishing increasing levels of hazard

To help you distinguish the potential for harm of different chemicals, the International Labour Organisation has categorized R-Phrases into bands of increasing hazard (see **Figure 7**).

A substance with an R-Phrase(s) that leads it to be categorized in Group C is more dangerous than a substance that falls in Groups A and B. Group E substances are the most dangerous. Group S tells you if a substance is dangerous to get on the skin or in a person's eyes.

1 This method of linking R-Phrases with hazard classification and the identification of needed control approaches is based wholly on the approach of the ILO Safework Chemical Control Toolkit produced by the Geneva-based International Labour Organisation © 2001, working in collaboration with the International Occupational Hygiene Association (IOHA) and Health and Safety Executive (HSE) in the UK.

Hazard Bands		Risk Phrases
Increasing Hazard	A	R36, R38, R65, R66; all dusts and vapours not allocated to another band
	B	R20/21/22, R40/20/21/22, R33, R67
	C	R48/20/21/22, R23/24/25, R34, R35, R37, R39/23/24/25, R41, R43
	D	R48/23/24/25, R26/27/28, R39/26/27/28, carcinogenic cat 3 R40, R60, R61 R62, R63, R64
	E	Muta cat 3 R40, R42, R45, R46, R49
	S	R21, R24, R27, R34, R35, R36, R38, R40/21, R39/24, R39/27, R41, R43, R66

Figure 7: Allocation of R-Phrases to hazard bands

Identifying unacceptable risks

To determine if significant risks are being created in your operation by the use of a particular chemical substance or preparation, you need to look at two factors:

- amount of the substance being used (**Factor 1**),
- ability to become airborne (**Factor 2**).

Both of these factors - scale of use and the ability to become airborne - influence the level to which people are being exposed to the substance and therefore have the potential to be harmed.

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

First, you need to decide if the amount of the substance in solid or liquid form that is being handled in a batch (or in a day for a continuous operation) can be described as small, medium, or large.

Figure 8 (refer to next page) can help you make this determination according to the weight/volume of the substance and the form in which it was delivered to you by the supplier.

Quantity	*Weight*	*How received from supplier?*	*Volume*
Small	Grams (g)	Packets or bottles	Millilitres (ml)
Medium	Kilograms (kg)	Kegs or drums	Litres (l)
Large	Tonnes (ton)	Bulk	Cubic metres (m3)

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

Figure 8: Determining the scale of use

Factor 2: How much of the substance gets into the air?

The physical form of a substance influences how likely it is to get into the air. In this respect, you need to consider the level of „dustiness“ for solids. For liquids, you need to look at the substance's „volatility“.

Use **Figure 9** to help you determine the level of dustiness and volatility (**Figure 10**) of a particular chemical substance.

Solids

The **dustiness** of a solid as determined as follows:

Low - Pellet like solids that don't break up. Little dust is seen during use (e.g. PVC pellets, waxed flakes).

Medium - Crystalline, granular solids. When used, dust is seen but settles out quickly. Dust is left on surfaces after use (e.g. soap powder).

High - Fine, light powders. When used, dust clouds can be seen to form and remain in the air for several minutes (e.g. cement, carbon black, chalk dust).

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

Figure 9: Determining the dustiness of substances

Liquids

Volatility refers to the ability of a liquid to turn into a vapour and therefore get into the air. To determine the **volatility** of a liquid, you need to find its boiling point (i.e. look on the MSDS available from the chemical supplier). Compare the boiling point against the descriptions below in order to determine the level of volatility:

Low - Boiling point above 150°C.

Medium - Boiling point between 150°C and 50°C.

High - Boiling point below 50°C.

⇨ For processes being carried out above room temperature (approximately 20°C), this will typically increase the volatility (i.e. increase the risk of the liquid turning into a vapour and entering the air).

⇨ If you are using a preparation made up 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 of substances

Determining the needed approach to control hazardous situations

The previous sections outlined the steps to determine:

√ the hazard band showing how the substance has been categorized,

√ scale of use (amount) of a substance,

√ its ability to become airborne (dustiness or volatility).

Once you have evaluated this information, then you can identify the approach (*see* ***Figure 11***) that is needed to prevent or control exposure to significant hazards that may be arising during the storage, use, handling, and disposal of

a particular chemical substance.

Use **Figure 11** to identify the needed control approach by matching the hazard band against the amount of the substance being used (in a batch or in a day) and its level of dustiness (for a solid) or volatility (for a liquid).

The numbers below indicate the needed control approach

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

Figure 11: Determining the needed control approach

What does „control approach“ mean?

The numbers 1 to 4 shown in **Figure 11** indicate four control approaches that can be implemented in the workplace to provide the adequate level of protection to prevent or minimize the risk of exposure to hazardous substances.

The four control approaches include:

1 - **General ventilation**
A good standard of general ventilation and good working practices are required.

2 - Engineering control
Local exhaust ventilation ranging from a single point extract close to the source of hazard to a ventilated partial enclosure is required.

3 - Containment
The hazard should be contained or enclosed; smallscale breaches may be acceptable.

4 - Special
Expert advice is needed to select the necessary control measure.

Tool 2 describes the range of actions that correspond to these control approaches with respect to:

- access,
- design and equipment,
- maintenance,
- examination and testing,

- cleaning,
- personal protective equipment (PPE),
- training and supervision.

By implementing the actions suggested for each of these aspects, you can reduce potential hazards and improve the management of chemicals within your operation.

Tool 2 - Description of control approaches

Control Approach 1: General ventilation

General principles

Scope

This control sheet is part of the ILO Chemical Control Toolkit and should be used when the toolkit identifies that a control approach 1 solution is appropriate. The sheet gives good practice advice on the application of general ventilation to the workplace and includes working in the open outside of a building. General ventilation is suitable for a range of small, medium and large scale tasks involving solids and liquids. This sheet identifies the minimum standards you need to apply to protect your health. It should not be used to justify a lower standard of control than that which may be required for process control or control of other risks.

Access

√ Try to keep unnecessary people away from the work area. Ensure that no one is working close by downwind.

Design and equipment

√ Ensure that there is unrestricted access to fresh air. This can be done by working outdoors. It may need doors and windows open, or it may need air to be supplied or removed by a powered fan.

√ If you work in a factory building, you will normally require a wall mounted fan to remove the dirty air and airbricks or louvres or ceiling vents to allow fresh, clean air in to the workroom to replace it.

√ Do not release dirty air near to the clean air intake.

√ Ensure, where possible that clean air flows past the worker then past the work area. In the open, use the wind to take dirty air away from you.

√ For factories, ensure that the size or number of fans is sufficient to remove the dirty air from the workplace (more than one fan may be needed). A minimum of 5 air changes an hour is recommended.

Maintenance

√ Keep any fans or extractors in good working order.

Examination and testing

√ Every day, check that the fans are working when they are switched on. A ribbon strip attached to the exhaust side of the fan cage can be used as an indicator that the fan is working.

Cleaning

√ Clean the work equipment and work area daily.

√ Clean up spills immediately.

√ Don’t clean up dusts with a brush or compressed air. Use a damp cloth or vacuum where possible.

√ Put lids on containers immediately after use.

√ Store containers in a safe place where they will not get damaged.

√ Store volatile liquid containers out of direct sunlight.

Personal Protective Equipment (PPE)

√ Check the material safety data sheet or ask you supplier to find out what PPE is needed.

√ Ask your protective equipment supplier for written

recommendations on the PPE that is suitable for your operations. Ask the supplier to train you and your workers in how to use, maintain and store the equipment.

√ Look after your protective equipment. When not in use, keep it clean and store it in a clean, safe place.

√ Change your protective equipment at recommended intervals or when it is damaged.

Training and supervision

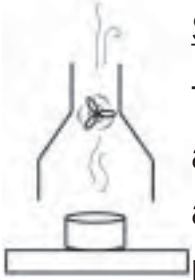
√ Tell your workers about the harmful nature of the substances they are working with and why they must use the controls and personal protective equipment (PPE) provided.

√ Teach them to handle chemicals safely. Check controls (e.g. fans) are working and what to do if something goes wrong.

√ Have a system to check that the precautions you have put in place are being followed.

Control Approach 2: Engineering Control

General principles



Scope

This control sheet is part of the ILO Chemical Control Toolkit and should be used when the toolkit identifies that a control approach 2 solution is needed. The sheet gives good practice advice on the application of local exhaust ventilation, which is the commonest form of engineering control. Local exhaust ventilation can be applied to a range of small, medium and large scale tasks involving solids and liquids. This sheet identifies the minimum standards you need to apply to protect your health. lt should not be used to justify a lower standard of control than that which may be required for process control or control of other risks.

Access

√ Keep unnecessary people away from the work area.

Design and equipment

√ Apply local exhaust ventilation (LEV) at the source of the exposure. There should be sufficient airflow to capture the dust or vapour before it disperses into the workplace. For dusts, airflows above 1 m/sec will generally be needed, for vapours airflows above 0.5 m/sec will generally be needed. The airflow should be measured at the origin of the dust or vapour.

√ Enclose the source of dust or vapour as much as possible to help stop it spreading.

√ Don’t allow the worker to get between the source of exposure and the LEV, or they will be in the path of the contaminated air.

- √ Where possible, locate the work away from doors and windows to stop, draughts interfering with the LEV and spreading the dusts or vapours.
- √ Keep extraction ducts short and simple and avoid long sections of flexible duct.
- √ Provide an easy way of checking the LEV is working such as a ribbon strip attached to the intake side.
- √ Discharge extracted air to a safe place away from doors, windows and, air inlets. Be careful that extracted air does not affect neighbours.

Maintenance

- √ Keep the LEV system in good working order.

Examination and testing

- √ Every day, check that the extraction system is working when it is switched on.
- √ Check the ducting once a week for signs of damage and repair when necessary.
- √ Have the system thoroughly examined and tested at least once a year.

Cleaning

- √ Only keep the amount of material which will be used that day in the workplace.

- √ Clean the work equipment and work area daily.
- √ Spill are the major cause of dust or vapour in the workplace. Clean up all spills immediately.
- √ Don’t clean up dusts with a brush or compressed air. Use a damp cloth or vacuum where possible.

- √ Put lids on containers immediately after use.
- √ Store containers in a safe place where they will not get damaged.
- √ Store volatile liquids out of direct sunlight.

Personal protective Equipment (PPE)

- √ Check the material safety data sheet or ask you supplier to find out what personal protective equipment is needed.
- √ Look after your protective equipment. When not in use, keep it clean and store it in a clean, safe place.
- √ Change your protective equipment at recommended intervals or when it is damaged.

Training and supervision

- √ Tell your workers about the harmful nature of these substances they are working with and why they must use the controls and PPE provided.
- √ Teach them to handle chemicals safely. Check controls are working and what to do if something goes wrong.

Control Approach 3: Containment

General principles

Scope

This control sheet is part of the ILO, Chemical Control Toolkit and should be used when the toolkit identifies that a control approach 3 solution is needed. The sheet gives good practice advice on containment and describes the key points you have to follow to reduce exposure to an adequate level. Containment can be applied to a range of small, medium and large scale tasks involving solids and liquids. This sheet identifies the minimum standards you need to apply to protect your health. lt should not be used to justify a lower standard of control than that which may be required for process control or control of other risks.

Access

√ The work area and equipment should be clearly marked.

√ Control entry to the work area. Only essential workers who have been trained should be allowed into hazardous work areas.

Design and equipment

√ Material handling should take place in a closed system that separates the worker from the hazardous material by a solid barrier.

√ Limited breaches of the closed system are permitted under controlled conditions i.e. where exposure times are only a few minutes and the quantity of material handled is small. For example, the taking of quality control samples.

√ Design the closed system for ease of maintenance.

- √ Where possible, keep the equipment under negative pressure to reduce leakage.
- √ Vent any exhaust air to a safe place away from doors, windows, walkways and air inlets. Care should be taken that the exhaust air does not affect neighbours.
- √ Provide a sump or separate drainage system to prevent leaks and spills form contaminating communal drains or waterways.

Maintenance

- √ Ensure all equipment used is maintained in good repair and efficient working order.
- √ Adopt a „permit to work“ system for all maintenance work.
- √ Document and follow any special procedures that are needed before the system is opened or entered, e.g. purging or washing.
- √ Don’t enter any closed vessel until it has been checked for hazardous or flammable substances and sufficient oxygen (between 19.5% and 23.5%).

Examination and testing

- √ Check all the equipment once a week for signs of damage and repair when necessary.
- √ Have the system thoroughly examined and tested at least once a year.

Cleaning

- √ Clean the work equipment and work area daily.
- √ Clean up spills immediately.
- √ Don’t clean up dusts with, a brush or compressed air.

Use a damp cloth or vacuum where possible.

√ Put lids on containers immediately after use.

√ Store containers in a safe place where they wont get damaged.

√ Store volatile liquid containers out of direct sunlight.

Personal Protective Equipment (PPE)

√ Check the material safety data sheet or ask you supplier to find out what personal protective equipment is needed.

√ Respiratory Protective Equipment (RPE) should not be needed for routine tasks, but may be necessary for cleaning and maintenance activities and when dealing with spills.

√ Be aware that some maintenance tasks may involve entry into confined spaces where supplied air RPE may be needed when there is not enough pure air to breathe.

√ Look after your protective equipment. When not in use, keep it clean and store it in a clean, safe place.

√ Change your protective equipment at recommended intervals or when it is damaged.

Training and supervision

√ Tell your workers about the harmful nature of the substances they are working with and why they must use the controls and PPE provided.

√ Teach them to handle chemicals safely, check controls are working and what to do if something goes wrong.

√ Have a system to check that the precautions you have put in place are being followed.

Tool 3 - Using Material Safety Data Sheets (MSDS)

A Material Safety Data Sheet (MSDS) provides valuable information that companies can use to optimise chemical use and improve workplace health & safety standards because it:

- Helps you determine the effect of the chemical on end products (e.g. intended characteristics, quality, etc.);

MSDSs usually contain the following information:

- √ name of chemical substance,
- √ information on composition of ingredients,
- √ physical & chemical properties,
- √ stability & reactivity,
- √ hazard identification,
- √ first-aid measures,
- √ fire-fighting measures,
- √ accidental release measures,
- √ proper handling & storage methods,
- √ needed controls/personal protection,
- √ toxicological information,
- √ ecological information,
- √ disposal considerations,
- √ transport information,
- √ regulatory information.

- 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;
- Spells out emergency procedures in case of spills, fire, explosion;
- Indicates steps for doing first-aid;
- Specifies the hazard level, which gives clues about the possible effects on water, soil, human health;

- Specifies the flashpoint (the lowest temperature at which a chemical gives off flammable vapour). The lower the flashpoint, the more dangerous the chemical is as a source of fuel for fire or explosion;

- Specifies the boiling point, which is used to determine the substance's volatility. The lower the boiling point, the higher the volatility.

Where should MSDSs be kept?

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

The information provided on the MSDS serves as the basis for providing oral and written instructions to workers, 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 Material Safety Data Sheet.

Where can you obtain MSDSs?

☞ Contact the supplier of the chemical:

- All providers of chemicals are legally obligated to prepare and provide information to buyers regarding the hazardous properties of substances.

- Ask your chemical supplier if the MSDS can be provided in the local language of the country in which your factory is based.

☞ 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 (MSDSs can be searched and printed out from this site in English).

- For preparations made up of 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.

Example of a Material Safety Data Sheet

☞ Note: The following is an example of a Material Safety Data Sheet retrieved from the Internet (www.chemexper.com). This site is a useful source of information on pure substances. For preparations made up of multiple components, you need to contact the supplier of that particular substance and request information about its actual hazards and characteristics (ideally in the form of an MSDS).

MSDS for Sodium sulfide, dried, 90%, balance water

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

MSDS Name: Sodium sulfide, dried, 90%, balance water
Catalog Numbers: 31018-0000, 31018-0100
Company Identification (Europe): Acros Organics N.V.
Janssen Pharmaceuticalaan 3a
2440 Geel, Belgium
Company Identification (USA): Acros Organics, One Reagent Lane,
Fairlawn, NJ 07410
For information in Europe, call: 0032(0) 14575211
For information in North America, call: 800-ACROS-01
For emergencies in Europe, call: 0032(0) 14575299
For emergencies in the US, call CHEMTREC: 800-424-9300

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

CAS#	Chemical Name	%	EINECS#
1313-82-2	Sodium sulfide, dried, 90%, balance water		215-211-5

Hazard Symbols: C
Risk Phrases: 31 34

****** SECTION 3 - HAZARDS IDENTIFICATION ******

EMERGENCY OVERVIEW

Contact with acids liberates toxic gas. Causes burns.
Hygroscopic. Light sensitive. Air sensitive.

Potential Health Effects

Eye:
Causes eye burns.

Skin:
Causes skin burns.

Ingestion:
Harmful if swallowed. Causes gastrointestinal tract burns.

Inhalation:
May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. Causes chemical burns to the respiratory tract. Inhalation may be fatal as a result of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema.

Chronic: Not available.

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

Eyes:
Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately.

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

Ingestion:
Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

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:
Treat symptomatically and supportively.

****** 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. Flammable solid.

Extinguishing Media:
In case of fire use water spray, dry chemical, carbon dioxide, or chemical foam.

Auto-ignition Temperature:
Not available.

Flash Point:
Not available.

NFPA Rating:
Health=3, Flammability=1, Reactivity=1

Explosion Limits:
Lower: Not available. Upper: Not available.

****** 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.

****** SECTION 7 - HANDLING and STORAGE ******

Handling:
Do not breathe dust, vapour, mist, or gas. Do not get in eyes, on skin, or on clothing. Use only in a chemical fume hood. Store and handle protected from air.

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 1910.134 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: Solid
Appearance: White to pink-cream powder and agglomerates
Odour: Not available.
pH: Not available.
Vapour Pressure: Not available.
Viscosity: Not available.
Boiling Point: Not available.
Freezing/Melting Point: 950 deg C
Decomposition Temperature: Not available.
Solubility: Not available.
Specific Gravity/Density: 1.8600g/cm3
Molecular Formula: Na2S
Molecular Weight: 78.04

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

Chemical Stability:
Not available.
Conditions to Avoid:
Incompatible materials, light, dust generation, exposure to air.
Incompatibilities with Other Materials:
Oxidizing agents, acids, aluminium, copper, zinc.
Hazardous Decomposition Products:
Oxides of sulfur, hydrogen sulfide.
Hazardous Polymerization:
Has not been reported

****** SECTION 11 - TOXICOLOGICAL INFORMATION ******

RTECS#:
CAS# 1313-82-2: WE1905000
LD50/LC50:
CAS# 1313-82-2: Oral, mouse: LD50 = 205 mg/kg;
Oral, rat: LD50 = 208 mg/kg.
Carcinogenicity:
Sodium sulfide, dried, 90%, balance water -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
See actual entry in RTECS for complete information.

****** SECTION 12 - ECOLOGICAL INFORMATION ******

For further information, contact Acros Organics.

****** SECTION 13 - DISPOSAL CONSIDERATIONS ******

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

****** SECTION 14 - TRANSPORT INFORMATION ******

US DOT
Shipping Name: SODIUM SULPHIDE, ANHYDROUS
Hazard Class: 4.2
UN Number: 1385
Packing Group: II
IMO
Shipping Name: SODIUM SULPHIDE, ANHYDROUS
Hazard Class: 4.2
UN Number: 1385
Packing Group: II
IATA
Shipping Name: SODIUM SULPHIDE, ANHYDROUS
Hazard Class: 4.2
UN Number: 1385
Packing Group: II
RID/ADR
Shipping Name: SODIUM SULPHIDE, ANHYDROUS
Dangerous Goods Code: 4.2(13B)
UN Number: 1385
Canadian TDG
No information available.

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

European/International Regulations
European Labelling in Accordance with EC Directives
Hazard Symbols: C
Risk Phrases:
R 31 Contact with acids liberates toxic gas.
R 34 Causes burns.
Safety Phrases:
S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S 45 In case of accident of if you feel unwell, seek medical advice immediately (show the label where possible).
WGK (Water Danger/Protection)
CAS# 1313-82-2: 2
Canada
CAS# 1313-82-2 is listed on Canada's DSL/NDSL List.
CAS# 1313-82-2 is not listed on Canada's Ingredient Disclosure List.
Exposure Limits
US FEDERAL
TSCA
CAS# 1313-82-2 is listed on the TSCA inventory.

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

MSDS Creation Date: 11/14/1996 Revision #0 Date: Original.

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.

Tool 4- Risk Phrases (R-Phrases) for hazardous substances

Nature of special risks attributed to dangerous substances and preparations

R-Phrases in (parenthesis are no longer in use)

Source: International Labour Organisation, International Occupational Safety and Health Information Centre (CIS/ILO), Information compiled from (last update September 1999): http://www.ilo.org/public/english/protection/safework/cis/products/safetytm/classify.htm

R1	Explosive when dry.
R2	Risk of explosion by shock, friction, fire or other sources of ignition.
R3	Extreme risk of explosion by shock, friction, fire or other sources of ignition.
R4	Forms very sensitive explosive metallic compounds.
R5	Heating may cause an explosion.
R6	Explosive with or without contact with air.
R7	May cause fire.
R8	Contact with combustible material may cause fire.
R9	Explosive when mixed with combustible material.
R10	Flammable.
R11	Highly flammable.
R12	Extremely flammable.
(R13)	Extremely flammable liquified gas.
R14	Reacts violently with water.
R15	Contact with water liberates highly flammable gases.
R16	Explosive when mixed with oxidizing substances.
R17	Spontaneously flammable in air.
R18	In use, may form flammable/explosive vapour-air mixture.
R19	May form explosive peroxides.
R20	Harmful by inhalation.
R21	Harmful in contact with skin.
R22	Harmful if swallowed.
R23	Toxic by inhalation.
R24	Toxic in contact with skin.
R25	Toxic if swallowed.
R26	Very toxic by inhalation.
R27	Very toxic in contact with skin.
R28	Very toxic if swallowed.

R29	Contact with water liberates toxic gases.
R30	Can become highly flammable in use.
R31	Contact with acids liberates toxic gas.
R32	Contact with acids liberates very toxic gas.
R33	Danger of cumulative effects.
R34	Causes burns.
R35	Causes severe burns.
R36	Irritating to eyes.
R37	Irritating to respiratory system.
R38	Irritating to skin.
R39	Danger of very serious irreversible effects.
R40	Possible risks of irreversible effects.
R41	Risk of serious damage to eyes.
R42	May cause sensitisation by inhalation.
R43	May cause sensitisation by skin contact.
R44	Risk of explosion if heated under confinement.
R45	May cause cancer.
R46	May cause heritable genetic damage.
(R47)	May cause birth defects.
R48	Danger of serious damage to health by prolonged exposure.
R49	May cause cancer by inhalation.
R50	Very toxic to aquatic organisms.
R51	Toxic to aquatic organisms.
R52	Harmful to aquatic organisms.
R53	May cause long-term adverse effects in the aquatic environment.
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.
R60	May impair fertility.
R61	May cause harm to the unborn child.
R62	Possible risk of impaired fertility.
R63	Possible risk of harm to the unborn child.
R64	May cause harm to breastfed babies.

R-Phrases in combination

R14/15	Reacts violently with water liberating highly flammable gases.
R15/29	Contact with water liberates toxic, highly flammable gas.
R20/21	Harmful by inhalation and in contact with skin.
R20/22	Harmful by inhalation and if swallowed.
R20/21/22	Harmful by inhalation, in contact with skin and if swallowed.
R21/22	Harmful in contact with skin and if swallowed.
R23/24	Toxic by inhalation and in contact with skin.
R23/25	Toxic by inhalation and if swallowed.
R23/24/25	Toxic by inhalation, in contact with skin and if swallowed.
R24/25	Toxic in contact with skin and if swallowed.
R26/27	Very toxic by inhalation and in contact with skin.
R26/28	Very toxic by inhalation and if swallowed.
R26/27/28	Very toxic by inhalation, in contact with skin and if swallowed.
R27/28	Very toxic in contact with skin and if swallowed.
R36/37	Irritating to eyes and respiratory system.
R36/38	Irritating to eyes and skin.
R36/37/38	Irritating to eyes, respiratory system and skin.
R37/38	Irritating to respiratory system and skin.
R39/23	Toxic: danger of very serious irreversible effects through inhalation.
R39/24	Toxic: danger of very serious irreversible effects in contact with skin.
R39/25	Toxic: danger of very serious irreversible effects if swallowed.
R39/23/24	Toxic: danger of very serious irreversible effects through inhalation and in contact with skin.
R39/23/25	Toxic: danger of very serious irreversible effects through inhalation and if swallowed.
R39/24/25	Toxic: danger of very serious irreversible effects in contact with skin and if swallowed.
R39/23/24/25	Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.
R39/26	Very toxic: danger of very serious irreversible effects through inhalation.
R39/27	Very toxic: danger of very serious irreversible effects in contact with skin.
R39/28	Very toxic: danger of very serious irreversible effects if swallowed.
R39/26/27	Very toxic: danger of very serious irreversible effects through inhalation and in contact with skin.
R39/26/28	Very toxic: danger of very serious irreversible effects through inhalation and if swallowed.
R39/27/28	Very toxic: danger of very serious irreversible effects in contact with skin and if swallowed.
R39/26/27/28	Very toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.
R40/20	Harmful: possible risk of irreversible effects through inhalation.
R40/21	Harmful: possible risk of irreversible effects in contact with skin.
R40/22	Harmful: possible risk of irreversible effects if swallowed.

R40/20/21	Harmful: possible risk of irreversible effects through inhalation and in contact with skin.
R40/20/22	Harmful: possible risk of irreversible effects through inhalation and if swallowed.
R40/21/22	Harmful: possible risk of irreversible effects in contact with skin and if swallowed.
R40/20/21/22	Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed.
R42/43	May cause sensitisation by inhalation and skin contact.
R48/20	Harmful: danger of serious damage to health by prolonged exposure through inhalation.
R48/21	Harmful: danger of serious damage to health by prolonged exposure in contact with skin.
R48/22	Harmful: danger of serious damage to health by prolonged exposure if swallowed.
R48/20/21	Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin.
R48/20/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R48/21/22	Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
R48/20/21/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R48/23	Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R48/24	Toxic: danger of serious damage to health by prolonged exposure in contact with skin.
R48/25	Toxic: danger of serious damage to health by prolonged exposure if swallowed.
R48/23/24	Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin.
R48/23/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R48/24/25	Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
R48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R51/53	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R52/53	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Tool 5- Safety Phrases (S-Phrases) for hazardous substances

S-Phrases in (parenthesis are no longer in use)

Source: International Labour Organisation, International Occupational Safety and Health Information Centre (CIS/ILO), Information compiled from (last update September 1999): http://www.ilo.org/public/english/protection/safework/cis/products/safetytm/classify.htm

S1	Keep locked up.
S2	Keep out of the reach of children.
S3	Keep in a cool place.
S4	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.
S8	Keep container dry.
S9	Keep container in a well-ventilated place.
S12	Do not keep 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.
S17	Keep away from combustible material.
S18	Handle and open container with care.
S20	When using do not eat or drink.
S21	When using do not smoke.
S22	Do not breathe dust.
S23	Do not breathe gas/fumes/vapour/spray (appropriate wording to be specified by the manufacturer).
S24	Avoid contact with skin.
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.
S28	After contact with skin, wash immediately with plenty of ... (to be specified by the manufacturer).
S29	Do not empty into drains.
S30	Never add water to this product.
S33	Take precautionary measures against static discharges.
(S34)	Avoid shock and friction.
S35	This material and its container must be disposed of in a safe way.
S36	Wear suitable protective clothing.

S37	Wear suitable gloves.
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).
S43	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 the label where possible).
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 this container or label.
S47	Keep at temperature not exceeding ...C° (to be specified by the manufacturer).
S48	Keep wetted 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.
(S54)	Obtain the consent of pollution control authorities before discharging to wastewater treatment plants.
(S55)	Treat using the best available techniques before discharge into drains or the aquatic environment.
S56	Dispose of this material and its container at hazardous or special waste collection point.
S57	Use appropriate container to avoid environmental contamination.
(S58)	To be disposed of as hazardous waste.
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.

S-Phrases in combination

S1/2	Keep locked up and out of reach of children.
S3/7	Keep container tightly closed in a cool place.
(S3/9)	Keep in a cool, well-ventilated place.
(S3/7/9)	Keep container tightly closed in a cool, well-ventilated place.
S3/9/14	Keep in a cool, well-ventilated place away from ... (incompatible materials to be indicated by the manufacturer).
S3/9/49	Keep only in the original container in a cool, well-ventilated place.
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).
S3/14	Keep in a cool place away from ... (incompatible materials to be indicated by the manufacturer).
S7/8	Keep container tightly closed and dry.
S7/9	Keep container tightly closed and in a well-ventilated place.
S20/21	When using do not eat, drink or smoke.
S24/25	Avoid contact with skin and eyes.
S36/37	Wear suitable protective clothing and gloves.
S36/39	Wear suitable protective clothing and eye/face protection.
S37/39	Wear suitable gloves and eye/face protection.
S36/37/39	Wear suitable protective clothing, gloves and eye/face protection.
S47/49	Keep only in the original container at temperature not exceeding ...C° (to be specified by the manufacturer).
S3/7	Keep container tightly closed in a cool place.
S7/47	Keep container tightly closed and at a temperature not exceeding ...°C (to be specified by the manufacturer).
S29/56	Do not empty into drains, dispose of this material and its container at hazardous or special waste collection point.

Tool 6- Symbols used for labelling

Source: International Labour Organisation, International Occupational Safety and Health Information Centre (CIS/ILO), Information compiled from (last update September 1999): http://www.ilo.org/public/english/protection/safework/cis/products/safetytm/classify.htm

• Dangerous Characteristics	• Label	• Meaning
Highly Flammable (F)		This symbol (F) 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 a 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+)		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.
Oxidising (O)		The symbol with the word 'oxidizing' refers to a substance which releases a lot of heat while it reacts with other substances, particularly flammable substances.
Explosive (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.
Toxic (T)		The symbol with skull and crossed bones with the word 'toxic' denotes a highly hazardous substance.
Very Toxic (T+)		The same symbol as above with the words '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)		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)		The symbol with 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)		The same symbol as above with the word 'irritant'.
Dangerous for the environment (N)		Can cause damage to fauna or flora or can cause pollution in natural waters