This book tells you how to limit chemical hazards in the work environment, and it gives answers to some of the questions which you have to face when working with chemical substances. How shall I choose a product? How do I carry out a risk assessment? Is a permit needed? How do I plan my work? How are chemical products to be labelled? Reference is also made to current legislation in the chemicals sector.

Chemicals Control in the Workplace is a radically revised and more comprehensive version of the publication “Chemicals Control – Limiting Chemical Hazards of the Work Environment”. It tells employers, supervisory staff, environmental officers, safety delegates and others how work involving hazardous chemical substances can be planned.

The publication was originally produced in collaboration with the Swedish National Chemicals Inspectorate and the Swedish National Rescue Services Board.
## List of contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>3</td>
</tr>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>What is a hazardous chemical substance?</td>
<td>4</td>
</tr>
<tr>
<td>Chemical products in use at the workplace</td>
<td>5</td>
</tr>
<tr>
<td>Choice of product</td>
<td>10</td>
</tr>
<tr>
<td>Risk assessment</td>
<td>11</td>
</tr>
<tr>
<td>Subdivision of activities</td>
<td>12</td>
</tr>
<tr>
<td>Risk assessment procedure</td>
<td>12</td>
</tr>
<tr>
<td>Documentation of risk assessment and measures decided on</td>
<td>17</td>
</tr>
<tr>
<td>Permits and other special requirements</td>
<td>19</td>
</tr>
<tr>
<td>Official permission</td>
<td>19</td>
</tr>
<tr>
<td>Permission within the operation</td>
<td>20</td>
</tr>
<tr>
<td>Other special requirements</td>
<td>21</td>
</tr>
<tr>
<td>Occupational exposure limit values and exposure measurements</td>
<td>21</td>
</tr>
<tr>
<td>Planning the work</td>
<td>22</td>
</tr>
<tr>
<td>Inhalation</td>
<td>22</td>
</tr>
<tr>
<td>Contact with eyes and skin</td>
<td>23</td>
</tr>
<tr>
<td>Ingestion</td>
<td>24</td>
</tr>
<tr>
<td>Risks of fire, explosion and reaction</td>
<td>24</td>
</tr>
<tr>
<td>Handling and safety instructions</td>
<td>25</td>
</tr>
<tr>
<td>The employee's responsibilities</td>
<td>27</td>
</tr>
<tr>
<td>Routines</td>
<td>28</td>
</tr>
<tr>
<td>Emergency routines</td>
<td>28</td>
</tr>
<tr>
<td>Routines for chemical control</td>
<td>28</td>
</tr>
<tr>
<td>Storage and packagings</td>
<td>30</td>
</tr>
<tr>
<td>Storage</td>
<td>30</td>
</tr>
<tr>
<td>Packagings</td>
<td>30</td>
</tr>
<tr>
<td>Risk of confusion</td>
<td>31</td>
</tr>
<tr>
<td>Information, labelling and signage</td>
<td>31</td>
</tr>
<tr>
<td>Information</td>
<td>31</td>
</tr>
<tr>
<td>Information checklist</td>
<td>32</td>
</tr>
<tr>
<td>Labelling</td>
<td>33</td>
</tr>
<tr>
<td>Signage</td>
<td>34</td>
</tr>
<tr>
<td>Transport operations</td>
<td>35</td>
</tr>
<tr>
<td>Checklists</td>
<td>36</td>
</tr>
<tr>
<td>Flowchart</td>
<td>37</td>
</tr>
<tr>
<td>Rules for the chemical sector</td>
<td>38</td>
</tr>
<tr>
<td>The Swedish Code of Statutes (SFS)</td>
<td>38</td>
</tr>
<tr>
<td>Provisions, General Recommendations issued by the Work Environmental Authority (AFS)</td>
<td>39</td>
</tr>
<tr>
<td>Statutory instruments issued by the Swedish National Electrical Safety Board (ELSÅK FS)</td>
<td>40</td>
</tr>
<tr>
<td>Statutory instruments issued by the National Board of Agriculture (SJVFS)</td>
<td>40</td>
</tr>
<tr>
<td>Statutory instruments issued by the National Chemicals Inspectorate (KIFS)</td>
<td>41</td>
</tr>
<tr>
<td>Statutory instruments issued by the Medical Products Agency (LVFS)</td>
<td>41</td>
</tr>
<tr>
<td>Statutory instruments issued by the National Environmental Protection Agency (NFS)</td>
<td>41</td>
</tr>
<tr>
<td>Statutory instruments issued by the National Board of Health and Welfare (SOSFS)</td>
<td>42</td>
</tr>
<tr>
<td>Statutory instruments issued by the National Rescue Services Board (SRVFS)</td>
<td>42</td>
</tr>
<tr>
<td>Classification and labelling of chemical products placed on the market</td>
<td>44</td>
</tr>
<tr>
<td>Proposed risk assessment checklist</td>
<td>46</td>
</tr>
</tbody>
</table>
Preface

Work with hazardous chemical substances always involves an element of risk. Safety in the workplace depends on careful planning of the work in question. There are rules on how to examine and limit chemical hazards.

An employer has the duty of studying and being familiar with all legislation containing stipulations for the activity conducted. It is the employer’s duty to ensure that hazardous chemical substances are safely handled.

This publication has been compiled for the purpose of acquainting employers, supervisory personnel, environmental officers, safety delegates and others with their duties in connection with the use of hazardous chemical substances. It also contains advice on planning methods.

This publication is updated to correspond with new legislation.

Introduction

The Work Environment Act, the Work Environment Ordinance and the statutory instruments applying to the activity concerned shall be made available to the employees (Section 5 of the Work Environment Ordinance). As regards the rules affecting your own handling activities, you must be acquainted with the exact wording of the stipulations. This is only possible by reading the enactments or provisions to which reference is made in this publication.

In addition to the instruments referred to here, there are provisions relating to certain types of activity, certain substances or groups of substances, as well as special legislation concerning, for example, radiation protection, pharmaceuticals, industrial alcohol, narcotic drugs and foodstuffs.

The employer’s duties of assessing the risks at work and organising safe handling in operations involving hazardous chemical substances are specified in the Provisions on Chemical Hazards in the Working Environment (AFS 2000:4).

Marginal references are given to important rules connected to the text, each relating to the paragraph where it is indicated. Titles of statutory instruments are given in abbreviated form only. Full titles are listed in the chapter “Rules for the chemical sector” on page 38.
What is a hazardous chemical substance?

“Hazardous chemical substance” is a chemical substance which can entail a risk of ill-health or accident because of

- its toxicological properties,
- its temperature,
- its radioactivity,
- displacement of atmospheric oxygen or
- because it increases the risk of fire, explosion or some other dangerous chemical reaction.

The term ill-health includes both permanent and passing conditions. Where certain hazardous chemical substances are concerned, the symptoms of ill-health do not appear until long after exposure has occurred. Passing ill-health includes, for example, nausea and irritation of the eyes. Ill-health of an enduring nature can take the form of allergy, cancer or disorders of the nervous system.

The Work Environment Act uses the word substance in a different sense from the Environmental Code and the Provisions of the National Chemicals Inspectorate. The expression “substance capable of causing ill-health or accidents” as used in the Work Environment Act also includes composite products and materials which can be a cause of ill-health and accidents when used in a certain way.

Note that hazardous chemical substance can constitute the surface layer of a material or device, as for example in the case of pesticides on disinfected seedlings: some pesticides may cause ill-health when the seedlings are handled. Hazardous chemical substances may also be present inside materials, entailing a risk when the materials are handled and machined. The impregnating agent inside impregnated timber is one such example.

Materials which in themselves are not hazardous chemical substances can form substances of this kind when handled in a certain way, as for example when quartz in dust form is generated by the machining of quartziferous blocks or stone or when a plastic is heated and breaks down into gases dangerous to health.

Substances which can entail a risk on account of their toxicological properties include, for example, those which are very toxic, toxic, harmful, corrosive, irritant, sensitising, carcinogenic, toxic to reproduction or capable of causing heritable genetic damage. Substances capable of causing irritative eczema after prolonged skin contact are also referred to. Heavy concentrations of dust can have a toxicological effect on the respiratory tract without the composition of the dust being classifiable as dangerous to health.

An intrinsically harmless gas can, if added to the air, change its composition in such a way that the oxygen content falls to a level where the inhaled air becomes asphyxiating. The composition of the air can also be changed by chemical or biological processes consuming oxygen.
Chemical products in use at the workplace

The products purchased have to be classified and labelled by the manufacturer or importer. Danger symbols on an orange-coloured ground indicate a chemical product dangerous to health or flammable, according to the regulation by the National Chemicals Inspectorate. Class 2 and 3 of flammable goods, according to SRVFS 2005:10, are also included in this category but do not carry danger symbols.

![Figure: Example of a label for a product dangerous to health and flammable.](image)

Where chemical products dangerous to health or flammable are concerned, in addition to the general stipulations, the special provisions shall also be complied with in the workplace. These provisions mean that:

- The products must be listed.
- Written information on risks and safety shall be available.
- The products shall be kept labelled in accordance with special rules.

List

The employer must ensure that someone keeps a regular inventory of the chemical products present and – other than in certain exceptional cases – compiles a list of those which are dangerous to health or flammable.

The list shall give the names of the products in systematic order and convey information regarding their hazardous nature. Data from the product labelling, such as symbol letter or category of danger, possibly combined with risk phrases (see “Classification and labelling of chemicals placed on the market”, page 44, can be used to indicate the nature of the hazard. The list shall be kept updated and shall include the date when it was last altered. There are various ways of keeping lists, e.g. as written lists or, given a
manageable number of products, in the form of a file containing the safety data sheets of the products.

**Written information on risks and safety**

It is the duty of the supplier of a chemical product dangerous to health or flammable to provide a *safety data sheet* stating the properties of the product from the viewpoint of risks and safety to the professional user. Safety data sheets shall contain all data relevant to the protection of health, safety and environment under 16 mandatory headings; see figure below.

<table>
<thead>
<tr>
<th>SAFETY DATA SHEET HEADINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identification of the product and of the company.</td>
</tr>
<tr>
<td>2. Composition/information on ingredients</td>
</tr>
<tr>
<td>3. Hazards identification.</td>
</tr>
<tr>
<td>4. First aid measures.</td>
</tr>
<tr>
<td>5. Fire-fighting measures.</td>
</tr>
<tr>
<td>6. Accidental release measures.</td>
</tr>
<tr>
<td>7. Handling and storage.</td>
</tr>
<tr>
<td>8. Exposure controls/personal protection.</td>
</tr>
<tr>
<td>9. Physical and chemical properties.</td>
</tr>
<tr>
<td>10. Stability and reactivity.</td>
</tr>
<tr>
<td>11. Toxicological information.</td>
</tr>
<tr>
<td>15. Regulatory information.</td>
</tr>
<tr>
<td>16. Other information.</td>
</tr>
</tbody>
</table>

*Figure: The main heading which the safety data sheet has to contain.*

A chemical product, dangerous to health or flammable, may not be used before the necessary written information on risks and safety about the product is available to the employees concerned. In cases where the supplier is under no obligation to furnish a safety data sheet – for example, in connection with direct importation or in-house production – the employer must see to it that the corresponding information is compiled or procured. In a laboratory, manuals containing risks and safety information may provide sufficient information for certain users.

**Labelling at the workplace of chemical products dangerous to health or flammable**

Packagings with supplier’s labels as instanced on page 5 meet the requirements for labelling at the workplace. Other packagings and containers, e.g. those which you yourself have filled with a hazardous chemical product are to be labelled with the components of this labelling as set out below, according to the main rule:

- *The name of the product.*
• The danger symbols and texts indicating the danger which, under current Provisions of the National Chemicals Inspectorate shall be present in connection with professional supply of the product.
• The applicable risk phrase or phrases in the table on page 9.

The labelling at the workplace may, however, be confined to the name of the product or be omitted altogether if other measures are taken which ensure that this does not entail an increased risk of ill-health or accidents.

Danger symbols and indications of danger

**Very toxic or Toxic**
Used for products which even in small quantities can cause poisoning or serious permanent injury, death, cancer, injury to the unborn child, heritable genetic damage or impairment of fertility.

**Corrosive**
Corrosive products can inflict painful wounds which are slow to heal. Splashing in the eyes can cause permanent vision impairment. The risk phrase Causes severe burns is applied to corrosive substances causing deep injury in less than three minutes.

**Harmful**
Products which are harmful can cause the same types of poisoning and permanent injury as toxic products, but by exposure to slightly larger quantities. Also applied to products which can cause allergy when inhaled.

**Irritant**
Irritant products can cause symptoms where the agent has, for example, come into contact with airways, the skin or eyes. Most often the effect is directly observable in the form of inflammation, smarting or suchlike. Used, for example, on products which can cause allergy through skin contact, irritation of the eyes or serious damage to the eyes.

**Extremely flammable or Highly flammable**
Liquids with this symbol emit fumes which can ignite or explode when mingled with air. Solids and gases can also carry this symbol. Measures liable to cause a naked flame or sparks may not be taken where flammable goods can ignite.

**Oxidizing**
Oxidizing products can react violently/explosively on coming into contact with certain other substances.

**Explosive**
Impacts, friction or heat may cause the product to explode.
Dangerous to the environment
This symbol shall be displayed on substances capable of harming the environment. The effect may be immediate or long-term.

Moderately harmful
The symbol was used according to previous Swedish rules. It may still be used, voluntarily, on products which can cause poisoning after ingestion of a relatively large amount.
Table

The following table shows the risk phrases which shall be included, where applicable, in labelling of a chemical product at the workplace to supplement the name and the danger symbol with indication of danger.

As regards other risk phrases on the supplier’s label, the indication of danger beneath the symbol informs on the risk.

Note that the texts on the labels shall be in Swedish!

<table>
<thead>
<tr>
<th>Risk phrase</th>
<th>Alternative wording</th>
</tr>
</thead>
<tbody>
<tr>
<td>R10 Brandfarligt (Flammable)</td>
<td>Brandfarligt (Flammable)</td>
</tr>
<tr>
<td>R35 Starkt frätande (Causes severe burns)</td>
<td>Starkt frätande (Highly corrosive)</td>
</tr>
<tr>
<td>R42 Kan ge allergi vid inandning (May cause sensitisation by inhalation)</td>
<td>Kan ge allergi (May cause sensitisation)</td>
</tr>
<tr>
<td>R43 Kan ge allergi vid hudkontakt (May cause sensitisation by skin contact)</td>
<td>Kan ge allergi (May cause sensitisation)</td>
</tr>
<tr>
<td>R45 Kan ge cancer (May cause cancer)</td>
<td>Kan ge cancer (May cause cancer)</td>
</tr>
<tr>
<td>R46 Kan ge ärftliga genetiska skador (May cause heritable genetic damage)</td>
<td>Kan skada arvsmassan (May damage genetic material)</td>
</tr>
<tr>
<td>R49 Kan ge cancer vid inandning (May cause cancer by inhalation)</td>
<td>Kan ge cancer (May cause cancer)</td>
</tr>
<tr>
<td>R60 Kan ge nedsatt fort plantningsförmåga (May impair fertility)</td>
<td>Reproduktionsstörande (Toxic to reproduction)</td>
</tr>
<tr>
<td>R61 Kan ge fosterskador (May cause harm to the unborn child)</td>
<td>Reproduktionsstörande (Toxic to reproduction)</td>
</tr>
<tr>
<td>R62 Möjlig risk för nedsatt fortplantningsförmåga (Possible risk of impaired fertility)</td>
<td>Reproduktionsstörande (Toxic to reproduction)</td>
</tr>
<tr>
<td>R63 Möjlig risk för fosterskador (Possible risk of harm to the unborn child)</td>
<td>Reproduktionsstörande (Toxic to reproduction)</td>
</tr>
<tr>
<td>R40* Misstänks kunna ge cancer (Limited evidence of a carcinogenic effect)</td>
<td>Kan ge cancer (May cause cancer)</td>
</tr>
</tbody>
</table>

* Since 30 July 2002, R340 is replaced by R40.
Choice of product

In the selection of products, all risks of ill-health and accidents which the handling may entail – and not just chemical hazards – shall be taken into account. Replacement of a product can mean using another working method, and it is therefore important to assess the risks of the combination of method and product and to factor in hazards of a musculoskeletal nature, for example.

At a temporary workplace indoors or in a confined space, products shall be used which are free from organic solvents or water-borne products, unless other products are required for technical or cultural-historical reasons.

Accident risks can vary from one working method to another. They may be greater if it is decided to grind a surface mechanically instead of using a chemical agent. High-pressure cleaning is one method which can entail accident risks. The risk of slipping can also vary from one substance or method to another. The risk of hearing impairment is another important factor to be considered if the choice is between methods with different noise levels.

There are of course other risks besides those of the work environment to be taken into account when selecting products, e.g. risks to the external environment. Refuse and emissions can impact on the external environment. The substances added to a product can pose risks to the user of the product or when the product eventually becomes waste.

A number of particularly hazardous substances are subject to limitations through prohibition or phase-out plans. Substances of this kind include asbestos, methylene chloride, trichloroethylene, tetrachloroethene, lead, cadmium and mercury.

In principle, product selection means assessing the risks of the different options. The choice between two chemical substances can often be simplified by identifying the properties which distinguish them and then basing the assessment on those properties.

CRITICAL PROPERTY
A systematically conducted risk assessment often shows which property of the substance handled is the critical one, i.e. has the most important bearing on the choice of product. If a property of this kind has been identified, a search can then be made for alternatives which are less dangerous in this respect.
Risk assessment

A new activity may not commence until a risk assessment has been carried out and the necessary measures taken. The employer shall also regularly investigate working conditions and assess the risks in the existing activities. The risk assessment shall form the basis of decisions concerning:

- Choice of product, working method and working equipment.
- Risk reduction measures to be taken.
- Handling and safety instructions to be given.
- Preparedness and first-aid routines that are needed.

The results of the risk assessment and the risk reduction measures decided on shall be documented in a manner appropriate to the gravity of the risks. The risk assessment shall be updated when there is a change in the operation or when the risk panorama is changed by the emergence of new information. The documentation shall be kept up to date, dated and signed by the employer. The employees concerned shall be kept informed of the documentation and have access to it.

When assessing the chemical risks of the work environment, the hazardous chemical substances which occur or can be expected to occur in the operation shall be identified. If one or more hazardous substances occur or can be expected to occur, an assessment shall be made of the risk of these substances causing ill-health or accidents. If there is reason to suspect that the activity gives rise to air contaminants, the extent of exposure shall be investigated.

The risk assessment shall take into account:

- The hazardous properties of the hazardous chemical substances identified, both separately and taken together.
- The information on hazardous properties and necessary measures for the protection of health and safety that shall be provided by the supplier.
- The mode of handling, working equipment, quantity, pressure and temperature, the preventative measures taken in connection with handling and other preconditions in the activity where the hazardous chemical substances occur.
- Exposure to the hazardous chemical substances; its nature, level and duration.
- Reports from the activity concerning discomfort, ill-health or accident thought to be connected with chemical substances occurring.
- Conclusions which can be drawn from any health surveillance already undertaken.

Documentation which may be needed from the operation includes, for example, drawings, registers of injuries and incidents, and instructions and risk assessments compiled previously.
Subdivision of activities

The success of risk assessment hinges on a practical, workable subdivision of the activities. It is often a good idea to start with general assessments for the different departments, identifying those parts where more detailed assessments need to be made.

Very often it can be appropriate to divide up the operation according to the activities performed and then to make a separate assessment of each activity involving hazardous chemical substances. Degreasing of manufactured parts, for example, can be counted as one activity and painting of them as another.

In an operation where the chemical hazards of the work environment are few, small and easy to assess, inventory and risk evaluation can instead be carried out room by room during the regular safety inspection and at the same time documented in the safety inspection record. A room-by-room audit of the operation makes it easier to notice peripheral activities, such as coffee-making.

Tasks where the hazards involved cannot be known in advance need to be assessed just as they are to be carried out. It is then advisable in the course of planning for routines to be created for these tasks, to ensure that this risk assessment will be carried out by a competent person.

Risk assessment procedure

See also “Proposed risk assessment checklist” on page 46.

What is the risk assessment to include?

In order to foresee the risks and judge which of them has a bearing on health and safety, it is important to be closely familiar with the handling operation and to have an adequate knowledge of the substances occurring. It is very often appropriate for the task of risk assessment to be given to a group possessing the different kinds of competence that are needed. Such a group may, for example, consist of supervisors, other employees, safety delegates and methods development specialists. A group with no previous experience of systematic risk assessment may need the support of a consultant or expert, e.g. from the occupational health service. Supervisors in charge of flammables and explosives normally need to take part.

It is important that everyone concerned should clearly understand what the risk assessment is to include, e.g. whether storage and transport of substances are also to be assessed.

If it is decided to base the risk assessment on activities, the implications of each activity defined have to be made clear. In the case of a simple handling operation, it may be sufficient to establish what substances are used and what is done with them. In other cases a closer description may be
needed of constituent substances, reactions, substances formed, quantities, temperature, pressure, method, equipment, media for heating and cooling and other relevant conditions.

Part of the risk assessment involves identifying the substances formed in the workplace. Consider, for example, whether hot substances, atmospheres with low oxygen content, potentially explosive concentrations of dust, exhaust fumes, hazardous dust or smoke may occur.

Information about the hazardous substance

Safety data sheets are information provided by the manufacturer, importer or others placing a hazardous chemical product on the market about its properties from a risk and safety viewpoint. This information shall make it possible for the professional user to take the necessary measures for the protection of health and the environment and for safety to be achieved in the workplace.

The employer decides whether the data received from the supplier are sufficient for the handling operation involved. He may need to obtain further information or carry out investigations of his own. If exposure to a substance is judged to be potentially significant, this calls for a close knowledge of the hazard entailed by the substance, so that harmful exposure can be avoided. When the handling operation can cause hazardous chemical substances to be emitted from a surface layer or material, e.g. in the course of heating or grinding, an assessment should be made of whether the surface layer or material contains any substance necessitating extra safety precautions.

The harmful effects of simultaneous exposure to several substances are frequently unknown. By always working in such a way as to minimise exposure, you have done what you can to protect yourself against unknown combined effects.

Intrinsic properties

For risk assessment purposes, the hazardous properties of a substance can be divided into:

- Danger to health when inhaled.
- Danger to health when coming into contact with the skin and eyes.
- Danger to health when ingested.
- Flammability and explosiveness.
- Reactive properties.

After reading the suppliers’ safety data sheet, one should have acquired sufficient understanding of the substance’s inherent properties to be able to assess their relevance to the handling operation involved. In order to assess the risk which the handling entails, it may be important to know whether injury occurs immediately or only in the long term and also how serious the injury is.
### Route of Exposure / Danger

<table>
<thead>
<tr>
<th></th>
<th>Inhalation</th>
<th>Skin contact</th>
<th>Ingestion</th>
<th>Flammability</th>
<th>Reactivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inherent properties</strong></td>
<td>Non-volatile.</td>
<td>Even brief</td>
<td>A mouthful will harm the oesophagus and possibly the lungs. Trace quantities are not dangerous</td>
<td>Non-flammable</td>
<td>Can form toxic gas on coming into contact with “Metal A”</td>
</tr>
<tr>
<td></td>
<td>Drops of liquid can harm the respiratory organs if inhaled</td>
<td>contact results in corrosive injuries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Risk in handling?</strong></td>
<td>No. Inhalable droplets do not form</td>
<td>Risk of splashing at stages 1 and 4</td>
<td>Splashing into an open mouth entails some risk of ingestion</td>
<td>“Metal A” is not normally used, but may be in the event of spillage</td>
<td>Yes.</td>
</tr>
<tr>
<td><strong>Are precautions necessary?</strong></td>
<td>Yes</td>
<td>Countered by the measures taken to prevent skin contact</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Protective measures in handling</strong></td>
<td>Gloves and face shield shall be worn</td>
<td>Information needs to be provided concerning the reactive risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Emergency preparedness</strong></td>
<td>Access to eyewash and rinsing facility</td>
<td>Prepare suitable equipment for collecting spillage</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure:** Questions to ask when assessing the handling of a hazardous chemical substance. See also “Proposed risk assessment checklist”, page 46.

This example is intended to illustrate a procedure for assessing the use of a notional corrosive product, not the documentation of the assessment.

A special method of risk analysis often has to be used if the handling operation involves chemical processes or complicated technical apparatus.
Figure: The example is trying to show parts of the planning before use of a fictitious solvent.
The workplace had already much of what was needed, e.g. sprinklers had been installed in the room and the organisation was experienced in the handling of flammables, having the routines, training and knowledge of the legislation. The measures listed are those they understood were missing when carrying out the risk assessment.
This is therefore not an example of which measures to take in other situations and also not an example of how to document a risk assessment.

<table>
<thead>
<tr>
<th>Route of Exposure / Danger</th>
<th>Inhalation</th>
<th>Skin contact</th>
<th>Ingestion</th>
<th>Flammability</th>
<th>Reactivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inherent properties</td>
<td>Very high volatility. Dangerous to inhale. Can cause acute and chronic injury.</td>
<td>Can cause skin dryness or cracking on prolonged or repeated contact.</td>
<td>Harmful on ingestion of a recognisable amount.</td>
<td>Highly flammable.</td>
<td>No dangerous reactions foreseen.</td>
</tr>
<tr>
<td>Risk in handling?</td>
<td>Risk of exposure above occupational limit value during use. Risk of very high air concentration at spillage.</td>
<td>No, only risk of splashes.</td>
<td>No risk of ingestion.</td>
<td>Yes, the vapours can form an explosive mixture inside and near to &quot;equipment A&quot;. On spillage in the whole room.</td>
<td></td>
</tr>
<tr>
<td>Are precautions necessary?</td>
<td>Yes</td>
<td></td>
<td></td>
<td>Yes, present explosion protection document must be revised.</td>
<td></td>
</tr>
<tr>
<td>Protective measures in handling.</td>
<td>Adapted process ventilation to be installed on &quot;equipment A&quot;.</td>
<td></td>
<td></td>
<td>Electrical equipment to be designed for use in explosive atmosphere. Warning device for heated bearings to be installed.</td>
<td></td>
</tr>
<tr>
<td>Emergency preparedness.</td>
<td>Respiratory protection to use in event of spillage.</td>
<td></td>
<td></td>
<td>Some sprinkler nozzles to be moved. Regular emergency routine drills necessary.</td>
<td></td>
</tr>
</tbody>
</table>
Handling according to plan

In order to judge the importance of a hazardous property of a substance, one needs to know what exposure is liable to occur in the handling operation concerned. One also needs to know whether there is a risk of substances igniting or exploding and whether there is any possibility of dangerous reactions.

For each of the hazardous properties of the substance concerned, it is appropriate to assess whether the substance will be handled in such a way that the property entails a real risk.

INHALATION

Properties of the substance, such as volatility or dustiness, coupled with such factors as the quantity handled, temperature, whether handling is open or closed, ventilation, evaporation surface and aerosol formation, decide how heavy the concentration of the substance in respiratory air will be. If a general assessment shows that air contamination may occur, these conditions need to be investigated more closely. Basic sampling methods, e.g. using a detector tube, can sometimes be used to confirm that the exposure level is low. If the investigation shows cause to suspect that an occupational exposure limit value is being exceeded, an exposure measurement must be carried out; see “Occupational exposure limit values and exposure measurements”, page 21.

SKIN CONTACT

Depending on how quickly skin contact with the substance produces an effect, an assessment is made of the risk of harmful skin contact during different working operations. Note that the effect of a substance can be accentuated if it is heated in the course of handling. When handling substances which, even in small quantities, can cause disorders through exposure to them – sensitising substances, for example – it is important to remember that the outside of the packaging may also be contaminated by the substance contained.

FLAMMABILITY

If the substance handled has flammable properties, an assessment must be made of the risk of ignition through sparks, an open flame or suchlike. Electrostatic charging due to high current velocities can cause sparks to form, as can machining.

REACTIVITY

If the substance has reactive properties, then obviously it is quite essential to check that the planned mode of handling will not involve conditions capable of causing dangerous reactions.

What can go wrong?

It is also important to try to predict whether different occurrences can have serious consequences, e.g. human error, leaks, spillage, power failures or defects in different parts of the equipment. One can start by considering properties capable of inflicting serious injury after one single exposure or of causing a fire or explosion.
It is important to act on the experience to be derived from the incidents which occur (and which have to be reported to the supervisory staff, see “The Employee’s responsibilities”, page 27). Systematic, documented reporting of incidents will make this possible.

Risk valuation
After identifying a number of risks and judging the likelihood of their causing injury in the activity concerned, the next thing is to decide, with reference to each risk, the need or otherwise for safety precautions, or whether the procedure adopted is so dangerous that a substance handled or the working method used needs to be replaced. Exposure to air contaminants is compared with the occupational exposure limit value for the substance concerned.

Documentation of risk assessment and measures decided on

Documentation of the risk assessment and of the measures decided on normally contains:

• a description of the subject of the risk assessment,
• the hazardous chemical substances identified,
• their inherently dangerous properties,
• the exposure to which employees can be subjected,
• handling risks entailed by the properties,
  – both when handled as intended and if something goes wrong and
• the risk reduction measures decided on or decision that no measures need to be taken.

The documentation underlying the risk assessment, e.g. safety data sheets and exposure measurement reports, should be appended or referred to. It is also appropriate to append the instructions that have been drawn up.

Exhaustive documentation makes it easier to update the risk assessment.

It is not always necessary to identify a hazardous substance by its chemical composition. It can be sufficient to note, for example, that a grinding dust is formed and that, for the avoidance of exposure, an effective extraction device is needed.
Risk assessment of .................................................................

Taking part in the assessment:

Stages of production included:

Hazardous chemical substances identified and their hazardous properties

Substance 1:
Hazardous properties:

Substance 2:
Hazardous properties:

Exposure at different stages

Air contaminants

Skin contact

Handling risks due to the hazardous properties identified above

During planned handling

If something goes wrong

Measures decided on

Date: ..........................  Signature of employer: ..............................

Figure: Specimen headings for risk assessment documentation.
Permits and other special requirements

Official permission

Processing of a permit application normally has to be based on an investigation of the risks. The documentation required is specified in the appropriate legislation.

Environmentally hazardous activity

The Environmentally Hazardous Activity and Health Protection Ordinance, SFS 1998:899, identifies activities for which permission must be obtained under the Environmental Code.

The permit award sets out conditions for the activity, such as permissible effluent quantities and the way in which the company is to deal with its waste and wastewater. For notifiable or other activities the supervisory authority can issue conditions in the form of recommendations, injunctions or prohibitions.

Flammables and explosives

For professional handling of flammables permit from the municipal building committee.

For the production of explosives permit from the National Rescue Services Board.

For other handling of explosives permit from the police authority.

Holders of permits for the handling of flammables or explosives shall appoint supervisors for such handling. These persons are responsible for the compliance of handling with current provisions and conditions set out.

Welding, naked flame or suchlike

Measures capable of igniting flammables or explosives (welding, for example) are prohibited wherever flammables or explosives are handled in such a way that they may ignite. The permit-issuing authorities for flammables and explosives may grant exceptions to this prohibition. The Municipal Rescue Services Committee can grant exemptions for single occasions.

Asbestos

Asbestos and asbestos-bearing materials may not, with some exceptions, be used. The Work Environment Authority can grant a permit for the machining and processing of already existing asbestos and asbestos-bearing materials, and also for their handling in the course of demolition work.
Carcinogenic, sensitising or reproduction-disturbing substances

Handling of certain carcinogenic, sensitising or reproduction-disturbing substances enumerated in the Provisions on Occupational Exposure Limit Values and Measures Against Air Contaminants are subject to permission from the Work Environment Authority.

Pesticides

A special permit is required for the use of Class 1 pesticides. The product denomination indicates which authority grants permission.

Class 1 ASS or Class 1 AV, denotes agents (biocidal products) for which permits are granted by the Work Environment Authority. At present certain wood preservatives and antifouling paints are thus designated.

Class 1 L, denotes agents (plant protection products) for which permits are granted by the Swedish Board of Agriculture (which has delegated this power to the County Administrative Boards). These products are used in agriculture, forestry, gardens and greenhouses.

Class 1 SO, denotes agents whose use is subject to permission from the National Board of Health and Welfare. These products are mainly used in buildings.

Use of Class 2 agents which the supplementary denomination L is subject to knowledge requirements.

Importation and supply

Professional importation of extremely dangerous chemical products from countries which are not members of the EU, and professional supply of extremely dangerous or very dangerous chemical products, are subject to permission from the County Administrative Board.

Permission within the operation

Note that official permission may be required in certain cases.

Confined space

The Provisions on Chemical Hazards in the Working Environment stipulate written work permits for work in a confined space where there is a Class 1 or Class 2 flammable liquid or any other substance capable of causing an acute risk. The work permit is issued by the employer or a person acting on his behalf and shall contain the conditions and instructions necessary for safe handling.

Welding

The Provisions on Welding and Thermal Cutting stipulate work permits (welding permits) if the welding or thermal cutting is to be carried out in a place where there is a special danger of fire or explosion. This permit is issued by the employer or a person appointed by him. Necessary safety
provisions shall be appended to the permit. The welder shall confirm in writing his receipt of the provisions.

**Motor fuels**

S. 15 AFS 1992:18

The Provisions of the National Board of Occupational Safety and Health on Motor Fuels include similar stipulations concerning written work permits.

**Other special requirements**

AFS 2005:18

AFS 2006:1

In other cases too, certain handling operations are made subject to special requirements. **Training** is stipulated for personnel who, for example, are to handle certain thermosetting plastics and asbestos.

AFS 2005:6

**Medical surveillance** is stipulated for the handling of certain hazardous chemical substances, such as asbestos, lead, cadmium, quartz, thermosetting plastics and certain synthetic inorganic crystalline fibres.

AFS 2005:17

**Registration** of employees exposed to carcinogenic substances is stipulated in the Provisions on Occupational Exposure Limit Values and Measures Against Air Contaminants (AFS 2005:17).

**Occupational exposure limit values and exposure measurements**

Occupational exposure limit values are used for assessing air quality at workplaces. For direct comparison with an occupational exposure limit value, an exposure measurement is needed. This is aimed at clarifying the concentrations of the air contaminant which a person at work inhales. Occupational exposure limit values can also be used as supportive data, for example when choosing working methods and dimensioning ventilation facilities.

Occupational exposure limit values have been defined for about 350 substances. At concentrations below the limit value, the intention is for a person to be protected from injury even in the event of prolonged exposure. The limit is not absolute, however, because individual sensitivity can vary and both workload and exposure to other air contaminants can make a difference.

AFS 2005:17

When there is reason to suspect that an occupational exposure limit value has been exceeded, an exposure measurement shall be carried out to ascertain whether or not this is the case. The person planning and carrying out the measurement must have the requisite knowledge for doing so, e.g. concerning a suitable choice of method and equipment, the timing of the measurement and suitable persons to carry out the measurement on.
The results of the measurement shall be documented in a measurement report containing certain pre-specified data. The employees concerned shall be informed of the results of the measurement and shall have access to the documentation.

Annual exposure measurements, to be reported to the Work Environment Authority are stipulated for lead¹, cadmium², quartz³, styrene², ethylene oxide², propylene oxide², and certain synthetic inorganic crystalline fibres⁴.

### Planning the work

A risk which has been identified and judged in need of rectification is either connected with the intended handling or else occurs if a mistake is made or a malfunction occurs in the equipment. Risks due to errors and faults of different kinds should be combated in two ways: the errors and faults should be prevented from occurring in the first place, and their effects should be limited. Mistakes can sometimes be avoided by means of technical solutions, e.g. by making a valve impossible to open during certain stages of a process.

It is important to choose materials which are not affected by the substances and the environment to which they are exposed. Permanently installed piping is often preferable to hoses. Storage tanks and other receptacles containing hazardous chemical substances may need to be protected by barriers, if for example there is truck traffic involved.

Special routines may be necessary for inspecting and maintaining technical devices. Inspection and maintenance of process equipment may include, for example, checking gaskets, controls and safety equipment and, where necessary, replacing or adjusting them. Ventilation systems must be maintained and inspected at regular intervals.

### Inhalation

If there is believed to be a risk of oxygen shortage or some other acute health hazard in a partly or wholly confined space, a written work permit is required in order for employees to be allowed to work in the space. The oxygen content of the air may need to be assayed.

Work must be conducted so as to minimise exposure to air contaminants. If it has not been possible to avoid them completely through the choice of product, a method and equipment shall be chosen which generate only a small quantity of air contaminant. As a secondary course, the work can be segregated from the employees, if possible. As a third resort, contaminated air is led off by means of process ventilation, e.g. local extraction devices.
Respiratory protective equipment shall be used if adequate safety cannot be achieved by other planning measures. The equipment shall be supplied by the employer.

The form in which a substance occurs can make an important difference to the risk entailed by handling it. Dust propagation from chemical substances in powder form can be avoided, for example, by opting instead for a product in the form of paste, pellets, granulate, slurry or solution.

**Contact with eyes and skin**

Splashing in the eyes is the commonest form of chemical accident. Most eye accidents can be avoided by using eye protectors. Always consider the need for eye protection before using hazardous chemical substances.

Protective gloves, a face shield or a splash plate, for example, may serve to reduce the risks. Technical aids of different kinds can make handling safer. When transferring a substance from one receptacle to another, for example, it may be advisable to use a pump, tipping cradle or suchlike.

It is important to choose gloves, sleeve guards, boots, aprons, overalls etc. of materials which are impermeable to the hazardous chemical substances concerned. In order for gloves to protect the wearer, they must stand up to the work involved. A glove which is torn or contaminated on the inside often means just as serious a risk of skin damage as no glove at all.

Wherever there is a risk of skin contact, splashing or drenching from a substance capable of causing injury on coming into contact with the skin or eyes, there must be a device capable of flushing the substance away before the injury becomes serious. This can mean, for example, a decontamination shower, an eyewash facility or a wash basin. The devices needed will depend on the substance and how it is handled.

For substances requiring 15 minutes’ flushing to deal with splashing in the eyes, the eyewash device, for example, must have water of suitable temperature.

Many substances can harm the skin in the longer term or cause injury if transferred to the mouth or eyes. Anyone handling or otherwise coming into contact with a hazardous chemical substance in such a way as to involve a risk of ill-health must therefore observe meticulous personal hygiene. Skin contaminated with a chemical substance must be cleaned at once if there is a risk of skin injury or other ill-health resulting.

Barrier creams cannot take the place of protective gloves when working with a substance which causes harm on coming into contact with the skin, but they can facilitate cleaning of the skin after a dirty job. After washing the hands may need to be rubbed with skin cream.
Work and protective clothing which can cause ill-health or accidents because it is contaminated with a hazardous chemical substance should be replaced without delay. Spreading of hazardous chemical substances via clothing shall be avoided. Protective clothes which have been used for the handling of hazardous chemical substances should therefore be removed during breaks or when switching to other work.

**Ingestion**

Working methods whereby the mouth can come into contact with hazardous chemical substances are patently unsuitable. Good hygiene and precautions against splashing also address the risk of accidental ingestion.

**Risks of fire, explosion and reaction**

If the formation of ignitable concentrations in the air cannot be avoided by planning means, the equipment chosen must be of such a kind that no ignition sources (such as sparks or hot surfaces) will occur in it. In certain activities the risk of explosions may still be so great that premises and devices have to be planned so as to minimise the risk of injuries in the event of an explosion.

A liquid can become statically charged when flowing in a free jet, for example when it is being poured or in the course of paint-spraying. The risk of static charging can be avoided by pouring along the inside of the container and by using containers made of conductive materials which are connected with each other and earthed. Rules on potential equalisation requirements are contained in the Provisions of the National Inspectorate of Explosives and Flammables on Open Storage Tanks and Piping etc. for Flammable Liquids.

The risk of static electricity accumulating in clothing and footwear is counteracted if these are made of materials with low insulating capacity, such as cotton and leather. Semi-conductive shoes and flooring materials may be needed where there is a serious risk of an explosive atmosphere.

The Flammables and Explosives Ordinance contains rules prohibiting smoking, the carrying or lighting of a naked flame or any other measures capable of igniting flammable or explosive products wherever these products are handled. An exception from the general prohibition, e.g. as regards welding on the premises, can under certain conditions be obtained from...
the Municipal Building Committee or from the Municipal Rescue Services Committee.

ELSÄK-FS 1999:5
ELSAK-FS 2004:1

Rules concerning the electrical equipment to be chosen for handling flammable goods are contained in the High Voltage Provisions of the Swedish National Electrical Safety Board.

SRVFS 2004:7
AFS 2003:3

Rules indicating when premises, a space, part of a space or suchlike shall be classed as an explosion hazard area are contained in the Provisions of the National Rescue Services Board on Explosive Atmosphere in Connection with the Handling of Flammable Gases and Liquids and in the provisions of the Work Environment Authority on Work in Explosive Atmospheres.

Chap.4 KIFS 1998:8

The Safety Data sheet shall state the conditions, which may cause dangerous reactions, and also materials and specific substances to avoid.

Handling and safety instructions

S. 11 AFS 2000:4

The handling and safety instructions which are needed shall be conveyed to the employees in a language which they understand. The instructions shall be adapted to actual handling operations at the workplace. If necessary the instructions shall be in writing and shall be available at the workplace.

Handling and safety instructions for maintenance of line 12:

1. Check that the eyewash shower is in working order.
2. Block the agitator for inadvertent starting. Move the control to red position.
3. Put on a face mask.
5. Open the reaction vessel.
6. ....
7. ....

Issued (year, month, day) by

K. Andersson
Head of Chemical Production
Handling and safety instructions comprise:

- instructions on the procedure for a certain job or task,
- the safety precautions, use of personal protective equipment included, which are needed for the different tasks.

How detailed the instructions have to be and whether they need to be put down in writing must be decided in each individual case. The content of handling and safety instructions needs to be adapted to the difficulty of the task and to the needs and aptitudes of the individual. Where more complicated and extensive tasks or serious risks are involved, the instructions usually need to be put down in writing. Purely verbal instructions are often sufficient for a simple handling operation where the risks are straightforward. If the instructions have been put down in writing, they should be gone over verbally when distributed.

In certain cases the instructions need to point out tasks which are subject to written work permits. It is important that the instructions then given in the written work permit are directly geared to the specific situation and also make provision, for example, for the need of a safety watcher, given that solitary work is not permitted here.

The employer is responsible for the employees receiving the instructions they need. In large operations this task is normally delegated to the supervisor. The person issuing written instructions must see to it that they are adapted to actual conditions and are easy for the employees to understand. It is also important to verify that the instructions are complied with. Many injuries to casual employees – who are often young persons – are due to insufficient or unclear instructions.

It is important that the instructions should be drawn up by someone who is closely familiar with conditions at the workplace and has had a good deal of personal experience of similar work. Instructions for use or proposed handling and safety instructions drawn up by a person other than the employer, such as a supplier of equipment, a trade organisation or another company, can be used as a basis for the employer’s instructions.

Examples of points which may need to be covered in the instructions:

1. **The work the instructions refer to, the person issuing them and the date of issue.**

2. **How to prepare for the work, e.g.:**
   - Where the work is to be done.
   - Putting up of warning signs and cordons.
   - Checking of equipment and apparatus.
   - Stationing of safety equipment and spillage decontamination agents.

3. **Job description, step by step, showing for example:**
   - The quantities of different chemicals to be added, the order in which they are to be added and the dosage equipment to be used.
• Measures to be taken to reduce risks occurring, e.g. use of extraction devices and fume cupboards.
• Personal equipment to be used at the different stages.

4. What to do at the end of work, e.g.:
• How to dispose of waste.
• Decontamination and cleaning.
• Whether to clean the skin or the personal protective equipment used.

5. What to do in the event of an accident or incident (e.g. a violent reaction, fire, spillage or gas escape), e.g.:
• Measures which should be taken by the employees themselves.
• Whether protective equipment needs to be used.
• How to send for help.
• First-aid which may be needed.
• Which persons to inform of the occurrence.

**The employee’s responsibilities**

Safe handling requires work not only to have been properly planned and arranged but also to be conducted in accordance with the instructions given. The Work Environment Act makes it the employee’s duty to comply with Provisions issued and to use the protective devices and observe such caution in other respects as are needed for the prevention of ill-health and accidents.

An employee shall without delay report to the workplace management any ill-health or accident which can be connected with a chemical substance occurring. Incidents shall also be reported. In addition, it is important to report indisposition, e.g. nausea, headache or tiredness, which may entail difficulty in concentrating (thus augmenting the risk of accidents or ill-health).

Reports concerning ill-health and accidents shall be taken into account in the assessment of risks and may necessitate updating of the risk assessment.

The employer shall investigate the cause of ill-health, accidents and serious incidences at work so that these can be prevented in future.
Routines

Emergency routines

Routines shall exist to protect workers in the event of accidents, incidents or emergencies related to the occurrence of hazardous chemical substances. Safety drills shall be performed to the extent necessary in order for the routines to be complied with when an accident, incident or emergency occurs. In the event of a person being injured or suddenly being taken ill, suitable contingency arrangements and routines for first-aid should be on hand.

Routines mean clarifying in advance the measures to be taken in an emergency situation and by whom. Routines for discovering risks, e.g. leakage of hazardous chemical substances, and warning routines are also important. Special personal protective equipment may need to be available for the use of personnel who are liable to be exposed to the extra hazards which an accident implies.

Suitable equipment for fire-fighting and life-saving shall be available in connection with an activity where a dangerous substance occurs which can cause fire or explosion. This means equipment which can cope with fire incidents and minor outbreaks of fire, e.g. fire blankets, hand-held extinguishers or a pre-installed hose.

If chemical substances occur in such a way that:

- there is a heightened risk of a fire spreading rapidly,
- an outbreak of fire may cause an explosion or the formation of toxic gas, or
- escaping gas can cause immediate danger,

there shall be a written contingency plan for evacuation.

The contingency plan for evacuation is not to be confused with the evacuation plan, the contents of which include information about evacuation routes and alarm arrangements, to be posted in the premises.

Routines for chemical control

Where hazardous chemical substances are handled or formed, routines shall exist whereby:

- suitable working methods are used,
- equipment is maintained,
- premises are cleaned and
- good order is maintained.
The routines for chemical control work should, for example, include:

- Choice of products and purchasing.
- Risk assessment and planning of new or changed handling operation.
- Issue of handling and safety instructions and instruction of employees.
- Reception of hazardous chemical substances, their storage and re-packing.
- Introduction to new duties.
- Maintenance of equipment and ventilation.
- Waste management.
- Cleaning and collection of spilt substances.

Routines make clear who is responsible for different tasks, what a task involves and when different things have to be done. The routines shall be documented in writing if there are at least ten persons employed in the activity.

**Purchasing routines, purchasing control**

It is appropriate for every employer to define routines for purchasing procedure, showing among other things the documentation to be compiled before a purchase is decided on. It is appropriate to have a preliminary risk assessment of the handling operation ready before deciding to purchase.

**Waste**

Handling of waste constituting a hazardous chemical substance shall be planned in such a way that the substance can be securely disposed of, having regard to the risks which the waste can entail.

The person disposing of waste shall be given such particulars of its composition and hazards as are needed for safe handling.

Waste can be both solid and liquid. It may comprise residues of a hazardous chemical substance, contaminated material such as soaked cotton waste, discarded protective gloves and used decontamination agent, as well as packaging which has contained a hazardous chemical substance and has not been cleaned.

If the composition of the waste or the risks it can entail are not known, handling needs to be planned in such a way that the employees will be protected against the risks which the waste can reasonably be expected to involve. Different kinds of hazardous waste must not be brought together or mixed with other waste if it is not done to improve safety or is acceptable from an environmental point of view.

Activities involving the occurrence of hazardous waste are subject to certain obligations, such as notifiability and the duty of engaging an approved carrier and recipient for the hazardous waste.
Spillage

Spillage of a hazardous chemical substance can give rise to both health hazards and accident risks unless it is promptly collected and securely disposed of. It is advisable to have special decontamination agents available for absorption of spilled liquids. A retaining dike may be one way of preventing large-scale spillage from spreading. In addition to gloves other personal protective equipment may be needed, e.g. respiratory protective devices if the spillage involves a highly volatile substance. Spillage from certain organic solvents can entail both a heightened fire risk and a risk of solvent fumes being inhaled. In addition, spillage can entail skid hazards.

Storage and packagings

Storage

For the avoidance of health and accident hazards, hazardous chemical substances should be stored in a storage space intended for the purpose and arranged in such a way that any spillage etc. will not spread in a dangerous manner. A retaining dike may be needed, for example, for flammable, reactive and corrosive substances. Adequate, appropriately designed ventilation is important in stores and storage spaces.

Substances which together can give rise to heightened risks shall be stored separately. If, therefore, the intention is for substances to be stored together, it has to be ascertained whether this involves a heightened risk, e.g. whether they are liable to react violently together. The supplier’s safety data sheet shall provide information about substances which may cause dangerous reactions together with the product.

Chemical products dangerous to health shall be stored so as to be out of reach of small children and thoroughly segregated from foodstuffs. Extremely or very dangerous chemical products shall be stored out of reach of unauthorised persons.

Packagings

Packagings and containers for a hazardous chemical substance shall be made of such material and be of such design and strength that the risk of ill-health or accident due to their content of a chemical substance is averted. Packagings meeting the requirements for the transport of dangerous goods can normally be used for storing the substances they are approved for. When transferring a substance to a vessel other than the original packaging, the suitability of the receiving vessel must be verified.
Substances which during storage can give risk to air contamination entailing a risk of ill-health or accident shall as far as possible be stored in a closed package or container of such a kind that the occurrence of air contamination is prevented.

The risk of injury through skin contact shall be averted by keeping packagings and containers clean on the outside.

Risk of confusion

Hazardous chemical substances may not be stored in packagings or containers of such a kind as may lead to the substances causing ill-health or accidents through confusion of substances. If a substance is transferred to a new packaging or container, this too must be labelled in such a way that the contents and risks will be clearly identifiable.

Information, labelling and signage

Information

The employer shall inform the employees concerned of the health hazards and accidents risks entailed by hazardous chemical substances occurring at the worksite and how these risks are avoided. The employer shall ascertain that the employees concerned have understood the information.

Accurate information is important:

- In connection with hiring.
- In connection with a change of duties.
- When new substances are taken into service.

Repeated information can often be called for.
Information checklist

This list is an example only, and cannot be regarded as exhaustive for all worksites and hazards.

1. Information about risks and protection in the employer’s own job and about particular operations which may entail risks.

2. Other risks occurring at the worksite and how to avoid them.

3. Points for the employee to observe before starting on a new task. Routines for the issue and handling of safety instructions.

4. Use of personal protective equipment, where the equipment is available, how it is looked after and its limitations.

5. Legislation applying to the handling of the hazardous chemical substances occurring, e.g. occupational exposure limit values.

6. Where safety data sheets, or other written information on risks and safety and the list of hazardous chemical products can be found.

7. Current safety data sheets, other written information on risks and safety, labelling and signage.

8. The meaning of the various labelling symbols.

9. The evacuation plan and procedure to be observed if the alarm sounds.

10. Special measures to be taken in order to limit the damage resulting from an incident or accident, such as turning off stopcocks for gas or other media.

11. Use of fire-fighting and first-aid equipment and first-aid measures to be taken.

12. Other routines of internal chemical control, e.g. for the storage of hazardous chemical substances.
Labelling

S. 24 AFS 2000:4 Packagings, containers and pipelines holding a hazardous chemical substance shall be labelled with the particulars necessary for identifying the contents and the risks associated with them.

S. 40 AFS 2000:4 Special rules apply to chemical products classifiable as dangerous to health or flammable. If a chemical product is packed at the worksite or transferred to a container, certain parts of the supplier’s labelling shall be affixed to it. See “Labelling – at the workplace of chemical products dangerous to health or flammable”, page 9. In addition to this labelling, it may be important in some connections for the labelling to draw attention to reaction risks, such as violent reaction with water, self-ignition in air or emission of toxic gas.

S. 24 AFS 2000:4 Notice too the necessity of labelling waste containers if the waste constitutes a hazardous chemical substance. Ventilation ducts and filters connected to such containers may also need to be labelled in certain cases.

Materials and goods whose packagings may need to be labelled are those which have a surface layer of a hazardous chemical substance or are capable of emitting hazardous chemical substances when handled, e.g. packagings containing seedlings which have been treated with pesticide. Labelling can, for example, show the name of the product used, the risk in words and a danger symbol if one is applicable.

Labelling of piping

App. 3 AFS 1997:11 Rules requiring the labelling of piping to be positioned visibly in the vicinity of the most dangerous points such as valves and joints, and also at reasonably intervals, are contained in the Provisions of the National Board of Occupational Safety and Health on Safety Signs and Warning Signals at Workplaces.

S. 40 AFS 2000:4 In addition to the prescribed labelling, it is appropriate also to indicate the direction of flow and to use one or more colours, as per Swedish Standard, SS 741, for different types of content.

SÄIFS 1996:3 For a pipeline holding flammable medium, an arrow indicating the direction of flow and a colour indicating the type of content are mandatory.

Exceptions to the labelling requirement

S. 40 AFS 2000:4 Labelling may be confined to the name of the product or be omitted altogether if other measures are taken which ensure that this does not entail an increased risk of ill-health or accident.

Omission of labelling comes into question mainly in connection with brief handling of a hazardous chemical product in a vessel for use or dosage, where the contents of the vessels are obvious to all concerned.
Signage

S. 25 AFS 2000:4

Warning signs shall be put up to the extent necessary in order to prevent hazardous chemical substances causing ill-health or accidents.

Signs can, as required:

- Indicate a prohibition or a mandatory behavior.
- Give warning of a danger.
- Indicate first-aid equipment or fire-fighting devices.
- Indicate an evacuation route.

![First aid post](image1.png)  ![Do not extinguish with water](image2.png)

![Warning of radioactive material](image3.png)  ![Emergency exit](image4.png)

Figure: Examples of signs conforming to the Provisions on Safety Signs and Warning Signals at Workplaces, AFS 1997:11.
Transport operations

Where a hazardous chemical substance is being transferred or transported, precautions must be taken to ensure that the substance will not spread in the form of spillage, splashing or air contamination and by doing so cause harm. Breakable containers are best packed in an outer container provided with absorbent. The carrier needs to be acquainted with the risks and to be told what to do in the event of a breakage.

Transport operations outside the plant come under legislation on the carriage of dangerous goods. It is the consignor’s responsibility to decide whether the chemicals or chemical waste to be carried constitute dangerous goods and to classify them as the law requires. This classification differs from that enjoined by legislation on chemical products, and the labels to be used are different as well. The classification decides the content of the transport documents which the consignor has to send with the goods and also the labelling which is required. It is also the consignor’s responsibility to ensure that the goods are packed in approved packaging which is in good condition.

An approved carrier has to be engaged for the transport of hazardous waste. The transport document for hazardous waste shall indicate the type of waste concerned, preferably by means of the code, as indicated in App. 2 of the Waste Ordinance. When other, non-hazardous waste is to be carried, the main principle is that an approved carrier shall be engaged, but there are exceptions to this rule.

It is the duty of the carrier to comply with the rules for loading the goods. Special training is stipulated for the driver. Other stipulations include labelling of the vehicle and personal protective equipment in accordance with the transport documents concerned.

With some exceptions shall all activities carrying or despatching dangerous goods have one or more safety advisers. The safety adviser shall among other things ensure that the provisions on the carriage of dangerous goods are complied with, advise on activities relating to the carriage of dangerous goods and ensure that the operation has systems and methods for work with dangerous goods.

Detailed international provisions are contained in codes for different kinds of transport: ADR for road transport, RID for rail transport, IMDG for shipping transport and ICAO-TI for air transport.
Checklists

Knowledge

☐ List
☐ Safety data sheets
☐ Further information from the supplier, trade organisation or handbooks
☐ Stipulations in special legislation: permits, measurement, training, work permit issued by the employer

Accident preparedness

☐ Eyewash, decontamination shower
☐ Absorbent for spillage
☐ Personal protective equipment for incidents or escapes
☐ Alarm routines
☐ Safety watcher
☐ Fire-extinguishing equipment
☐ Life-saving, first aid
☐ Evacuation plan
☐ Drills

Handling

☐ Working method
☐ Equipment
☐ Premises
☐ Everything in good order
☐ Washing facilities
☐ Ventilation
☐ Personal protective equipment: protective clothing, eye protectors, gloves, respiratory protective devices
☐ Waste routines, labelling of waste, waste receptacles
☐ Storage: packaging, stores

Information

☐ Risks at different stages of work
☐ Incident-related risks
☐ Labelling: routines, symbols
☐ Accident preparedness
☐ Storage routines
☐ Purchasing routines
Do you have any hazardous chemical substances?

- Yes
  - Do you know enough about the substances?
    - Yes
      - Determine the chemical hazards of importance in your handling
    - Don’t know
      - Checklist KNOWLEDGE
      - Experience, new information

- No
  - Revise regularly

- Don’t know
  - Checklist KNOWLEDGE

Determine the chemical hazards of importance in your handling

- Is accident preparedness adequate in relation to the risks?
  - Yes
    - Are handling operations organised to prevent the risks?
      - Yes
        - Supply information about risks and routines
          - Give clear handling and safety instructions. Make sure they are complied with.
      - Don’t know
        - Checklist HANDLING OPERATIONS
  - Don’t know
    - Checklist ACCIDENT PREPAREDNESS
    - Experience, new information
Rules for the chemical sector

The following is a list of publications relating to the handling of chemicals. It is not exhaustive, and provisions relating to this field may be included in other rules than those mentioned here. All publications are in Swedish unless otherwise indicated.

The Swedish Code of Statutes (SFS)

website: www.lagrummet.gov.se

SFS can be ordered from Fritzes kundservice, SE-106 47 STOCKHOLM, tel. +46-(0)8-690 91 90, order fax +46-(0)8-690 91 91.

SFS 1977:1160  The Work Environment Act (AML)
SFS 1977:1166  The Work Environment Ordinance (AMF)
SFS 1982:821  The Carriage of Dangerous Goods Act
SFS 1982:923  The Carriage of Dangerous Goods Ordinance
SFS 1988:220  The Radiation Protection Act
SFS 1988:293  The Radiation Protection Ordinance
SFS 1988:868  The Flammables and Explosives Act
SFS 1988:1145  The Flammables and Explosives Ordinance
SFS 1993:1268  The Waste Oil Ordinance
SFS 1993:1283  The Cosmetics and Hygiene Products Ordinance
SFS 1998:808  The Environmental Code
SFS 1998:899  Environmentally Hazardous Activities and Health Protection Ordinance
SFS 1998:901  The Industrial Undertakings (Internal Control) Ordinance
SFS 1998:941  The Chemical Products and Biotechnical Organisms Ordinance
SFS 1999:381  The Serious Chemical Accidents (Measures for Prevention and Limitation Measures) Act
SFS 1999:382  The Serious Chemical Accidents (Measures for Prevention and Limitation Measures) Ordinance
SFS 2000:338  The Biocide Products Ordinance
SFS 2001:1063  The Waste Ordinance
SFS 2003:778  Civil Protection Act
Provisions and General Recommendations issued by the Work Environment Authority (AFS)

website: www.av.se

AFS can be ordered from Publikationsservice, Box 1300, SE-171 25 SOLNA, tel. +46-(0)8-730 97 00, fax +46-(0)8-735 85 55.

A catalogue (ADI 100) of all publications available can be obtained from the same address.

General Provisions
In addition there are detailed Provisions, relating to particular substances or handling operations.

AFS 1994:32 Pregnant and Breast-Feeding Employees
AFS 1995:5 Equipment for Use in Potentially Explosive Atmospheres
AFS 1997:11 Safety Signs and Warning Signals at Workplaces
AFS 1998:1 Ergonomics for the Prevention of Musculoskeletal Disorders (Available in English)
AFS 1998:4 Use of Working Equipment
AFS 1999:7 First Aid and Crisis Support
AFS 2000:1 Manual Handling
AFS 2000:4 Chemical Hazards in the Working Environment (Available in English)
AFS 2000:42 Workplace Design. Amended in AFS 2003:1
AFS 2001:3 Use of Personal Protective Equipment (Available in English).
AFS 2003:3 Work in explosive atmospheres
AFS 2005:17 Occupational Exposure Limit Values and Measures against Air Contaminants (Available in English).

Provisions relating to certain substances or groups of substances

AFS 1985:1 PCB (polychlorinated biphenyls)
AFS 1986:13 Oils
AFS 1992:18 Motor Fuels (Available in English)
AFS 1997:7 Gases
AFS 2005:5 Cytostatics and Other Pharmaceuticals with Enduring Toxic Effects
AFS 2005:6 Medical surveillance in worklife
AFS 2006:1 Asbestos
Provisions and General Recommendations on particular forms of handling
AFS 1984:15 Sewer Systems
AFS 1985:18 Hairdressing Work
AFS 1988:4 Lead Batteries
AFS 1992:7 Inorganic Surface Treatment
AFS 1992:9 Welding and Thermal Cutting
AFS 1993:3 Work in Confined Spaces, General Recommendations.
(Available in English.)
AFS 1997:10 Chemical Laboratory Work (Available in English).
AFS 2003:2 Rock Work

Statutory instruments issued by the Swedish National Electrical Safety Board (ELSÄK-FS)

website: www.elsakerhetsverket.se

Orders: Elsäkerhetsverkets publikationsservice, SE-120 88 Stockholm, tel. +46-(0)8-779 96 33, fax +46-(0)8-779 96 10.


Statutory instruments issued by the National Board of Agriculture (SJVFS)

website: www.sjv.se

Orders: Publikationsenheten, Jordbruksverket, SE-551 82 JÖNKÖPING, tel. +46-(0)36-15 50 00, fax +46-(0)36-19 05 46.

SJVFS 2005:51 Permits Skill Requirements and for Using Certain Pesticides
Statutory instruments issued by the National Chemicals Inspectorate (KIFS)

website: www.kemi.se

Orders: Kemikalieinspektionen, Box 1384, SE-171 27 SOLNA, tel. +46-(0)8-783 11 00, fax +46-(0)8-735 76 98.

KIFS 2005:5 EC-harmonized, binding classification and labelling
KIFS 2005:7 Classification and Labelling of Chemical Products.

Statutory instruments issued by the Medical Products Agency (LVFS)

website: www.lakemedelsverket.se

Orders: Fritzes kundservice, SE-106 47 STOCKHOLM, tel. +46-(0)8-690 91 90, order fax +46-(0)8-690 91 91.

LVFS 1999:4 Control of Radioactive Medical Products
LVFS 2004:12 Control of Cosmetics and Hygiene Products

Statutory instruments issued by the National Environmental Protection Agency (NFS)

website: www.environ.se

Orders: Naturvårdsverket, SE-106 48 STOCKHOLM, tel. +46-(0)8-698 10 00, Customer Service tel. +46-(0)8-698 12 00, fax +46-(0)8-698 15 15.

SNFS 1993:7 Handling of Fire-Extinguishing Devices Containing Halons etc.
SNFS 1995:7 Industrial Effluent Containing Certain Substances.
NFS 2003:24 Safeguards against Soil and Water Pollution in Connection with the Storage of Flammable Liquids.
NFS 2005:3 Carriage of Hazardous Waste
Statutory instruments issued by the National Board of Health and Welfare (SOSFS)

website: www.sos.se

Orders: Socialstyrelsen, SE-103 60 STOCKHOLM,
Customer Service tel. +46-(0)8-795 23 30, fax +46-(0)8-760 58 95.

SOSFS 2005:5  Permits for the Use of Certain Pesticides

Statutory instruments issued by the National Rescue Services Board (SRVFS)

website: www.srv.se

Orders: Fritzes kundservice, SE-106 47 STOCKHOLM,
tel. +46-(0)8-690 91 90, order fax +46-(0)8-690 91 91.

SRVFS 2002:3  Safety Advisers for the Carriage of Dangerous Goods
SRVFS 2004:3  Recommendations on systematic fire prevention.
SRVFS 2004:7  Explosive Atmosphere in Connection with the Handling of Flammable Gases and Liquids
SRVFS 2004:14  Carriage of Dangerous Goods by Road and Off-Road (ADR-S)
SRVFS 2004:15  Carriage of Dangerous Goods by Rail (RID-S)
SRVFS 2005:2  Measures for the Prevention and Limitation of Serious Chemical Accidents
SRVFS 2005:10  Certain Stipulations on Flammable Liquids

Statutory instruments issued (before the 1th of October 2001) by the National Inspectorate of Explosives and Flammables

Now within the responsibility of the National Rescue Services Board

SÄIFS 1993:4  List of Approved Explosives
SÄIFS 1995:6  Handling of Ammonium Nitrate
SÄIFS 1996:2  Handling of Flammable Gases and Liquids at Sales Outlets
SÄIFS 1996:3  Prohibitory and Warning Signs when Handling Flammables and Marking of Pipes for Flammable Gases and Liquids
SÄIFS 1996:4  Handling of Organic Peroxides
SÄIFS 1997:9  Open Storage Tanks and Pipelines etc. for Flammable Liquids
SÄIFS 1999:2  Handling of Hydrogen Peroxide
SÄIFS 2000:2  Handling of Flammable Liquids
Classification and labelling of chemical products placed on the market

The following table shows the connection between classification in categories of danger, with applicable risk phrases and the symbols and the indications of danger to be given in the labelling, according to KIFS 2005:7.

### Flammables and explosives

<table>
<thead>
<tr>
<th>Category of danger 1)</th>
<th>Symbol letter</th>
<th>Symbol</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosive (R2, R3)</td>
<td>E</td>
<td>Exploding bomb</td>
<td>Explosive</td>
</tr>
<tr>
<td>Oxidising (R7, R8, R9)</td>
<td>O</td>
<td>Oxidising symbol</td>
<td>Oxidising</td>
</tr>
<tr>
<td>Extremely flammable</td>
<td>F+</td>
<td>Flame</td>
<td>Extremely flammable</td>
</tr>
<tr>
<td>Highly flammable</td>
<td>F</td>
<td>Flame</td>
<td>Highly flammable</td>
</tr>
<tr>
<td>Flammable (R10)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

### Chemical substances and preparations dangerous to health

<table>
<thead>
<tr>
<th>Category of danger 1)</th>
<th>Symbol letter</th>
<th>Symbol</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very toxic (R26, R27, R28, R39)</td>
<td>T+</td>
<td>Skull and crossbones</td>
<td>Very toxic</td>
</tr>
<tr>
<td>Toxic (R23, R24, R25, R39, R48)</td>
<td>T</td>
<td>Skull and crossbones</td>
<td>Toxic</td>
</tr>
<tr>
<td>Corrosive (R34, R35)</td>
<td>C</td>
<td>Corrosion symbol</td>
<td>Corrosive</td>
</tr>
<tr>
<td>Harmful (R20, R21, R22, R48, R65, R68)</td>
<td>Xn</td>
<td>St. Andrew’s cross</td>
<td>Harmful</td>
</tr>
</tbody>
</table>
Irritant
(R36, R37, R38, R41)

Sensitising
(R42)
(R43)

Carcinogenic
(R45, R49)
(R40)

Mutagenic
(R46)
(R68)

Toxic to reproduction
(R60, R61)
(R62, R63)

---

Chemical substances and preparations dangerous for the environment

<table>
<thead>
<tr>
<th>Category of danger 1)</th>
<th>Symbol letter</th>
<th>Symbol</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerous for the environment (R50, R50 och R53, R51 och R53, R54, R55, R56, R57, R58, R59)</td>
<td>N</td>
<td>Dead tree and fish</td>
<td>Dangerous for the environment</td>
</tr>
<tr>
<td>(R52 och R53, R52, R53)</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

1) R-numbers in parenthesis refer to a risk phrase which the chemical product or flammable product shall be assigned when classified in accordance with rules issued by the National Chemicals Inspectorate.
Proposed risk assessment checklist

This is a suggested working approach which can be suitable for certain handling operations. Sometimes whole groups of substances can be assessed at once. If the work involves chemical reactions and the formation of new substances, more often than not a more advanced model is needed.

Begin with basics by gauging the extent of the risks involved by the hazardous chemical substances occurring, so as to appreciate the situations in which they are harmful. If the supplier’s information (normally the safety data sheet) does not confer this insight, it may be necessary to talk to the person responsible for the information and ask for elucidations.

It is important to clarify the limits of the risk assessment you propose undertaking.

Checklist

Risk assessment of:

The following handling/working operations are covered:

Hazardous chemical substances occurring:

- Substances used/stored:
- Substances formed:

Participators:

Instructions to be drawn up by:

Date: Signature, employer’s representative
Substance 1:

Dangerous to health when inhaled:
☐ Even brief exposure to small quantities is harmful.
☐ Prolonged or repeated exposure to small quantities is harmful.
☐ Exposure to larger quantities is harmful.

☐ High volatility or dustiness.
☐ Moderately volatile or dusty substance.
☐ Substance neither volatile nor dusty.

In which working operations can employees be exposed to fumes or dust?
How great is exposure during the various operations?
Is exposure measurement necessary?
What safety precautions are needed for different operations?
What unscheduled events can cause heavy atmospheric concentrations?
Maintenance/inspection measures for the avoidance of such occurrences?
What steps need to be taken to establish good accident preparedness?

Dangerous to health in contact with skin:
☐ Tissue damage occurs directly.

☐ Skin damage occurs if the substance is not removed from the skin.
   ☐ Permanent harm (e.g. cancer or allergy).
   ☐ Transient harm (heals if the exposure ends).

☐ Can be absorbed through the skin and harm other organs.

In which operations can employees be subject to skin contact or splashing?
What safety precautions are then needed?
What unplanned events can cause splashing or drenching?
Maintenance/inspection for the avoidance of such occurrences?
Accident preparedness?

Dangerous to health if swallowed:
☐ Can cause harm if trace quantities enter the mouth, e.g. via the fingers.

Is the working method of such a kind that skin contact is avoided?
Is the substance prevented from spreading to other premises?
Washing before breaks and visits to the toilet?

☐ Harmful if unintentionally swallowed in a noticeable quantity.
  Working methods potentially involving a risk of ingestion are always unsuitable.
Risk of fire/explosion:
□ Highly or extremely flammable (flash point >21°C).
□ Flammable (flash point 21-55°C).
□ Other flammable product.
□ Other risk information concerning the risk of fire, reaction or explosion.

Is there a risk of ignition/reaction?
- Naked flame, hot surfaces or sparks?
- Other circumstances which can cause reactions?
What changes are needed for the avoidance of fire/explosion?
What unplanned events can entail fire or explosion?
Maintenance/inspection for the avoidance of such occurrences?
Accident preparedness?

Other hazardous properties:
□ Can react violently with another substance or under certain conditions (e.g. heat, radiation).
□ Can damage certain materials.

Can these properties constitute a handling risk?
What changes need to be made?
Unplanned events which can have dangerous consequences?
Steps for the avoidance of such occurrences?
Accident preparedness?

Substance 2:
(Review as for Substance 1, etc.)