# Use of disinfectants in the health care sector: Chemical hazards and preventive measures

## Factsheet 2: General principles of prevention

**Foreword**

The Chemical Risks workgroup of the Health Services Section of the International Social Security Association (ISSA) has studied the risks linked to disinfection activities in the health care sector and the preventive measures that should be applied. This workgroup has defined a position shared by all the occupational health and safety organisations represented within the group: BGW (Germany), INRS (France) and Suva (Switzerland).

This project included a collaboration with the Infectious Risks workgroup of the Section, to summarise the general principles of disinfection (Factsheet 1) for the audience targeted by the current series (see below).

For practical reasons, the results of this work will be presented as a series of technical Factsheets:

Factsheet 1: Principles of disinfection

Factsheet 2: General principles of prevention

Factsheet 3: Hazards of chemical disinfectants

Factsheet 4: Selecting safe disinfectants

Factsheet 5: Surface disinfection

Factsheet 6: Instrument disinfection

Factsheet 7: Skin and hand disinfection

Factsheet 8: Specific procedures (disinfecting premises, medical equipment, linen and clothing)

Each factsheet contains the essential information relating to the theme covered, and can therefore be read separately. These factsheets are destined for use by those responsible for organising and performing disinfection tasks in the health care sector, by occupational physicians and by all those involved in preventing occupational risks – in particular occupational hygienists and safety officers – as well as interested personnel and their representatives.

For questions on hospital hygiene and environmental protection, the reader is invited to consult the specialised literature.

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Section on Prevention of Occupational Risks in Health Services

## 1. Introduction

The extent and intensity of disinfection tasks performed in health care institutions depend on the nature of the infectious risk. To obtain the required reduction in infectious risk when disinfecting the skin and hands, surfaces and medical equipment, those responsible for hygiene often have to use chemical disinfectants. This results in risks for workers due to the procedures applied and to the chemical properties of many of the ingredients found in disinfectants. Employers are required to identify the hazards, determine exposure and characterise the resulting risks for workers before chemical substances or products are used. They must also define the preventive measures which should be applied (Figure 1).

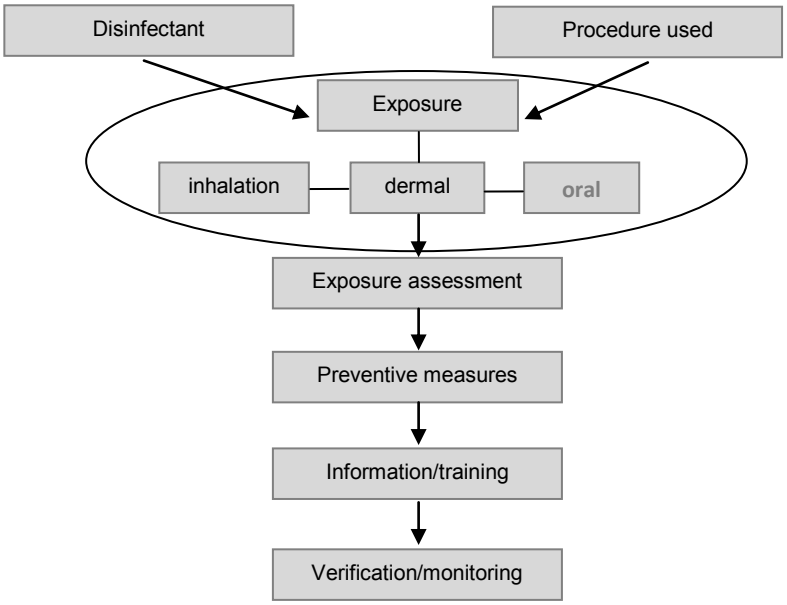


**Figure 1**: Assessing risks associated with disinfectants.

This factsheet describes the principles of prevention that should be applied when performing disinfection tasks in the health care sector. These principles are based on an analysis of the hazards encountered during these tasks.

## 2. Hazards linked to chemical disinfectants

Disinfectants are generally composed of one or more active substances which have a disinfectant action, they may also contain solubilising agents, surfactants, foam regulators, and sometimes perfumes. A German market study in 2010 was used to establish a list of 828 disinfectants. These were classed based on information present on their labels (Table 1).

**Table 1:** Disinfectants available in Germany classed according to labelling information (hazard symbols) [1].

| Group of products | Number of products | Hazard symbols | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Xi | Xn | C | O | N | F | F+ | none |
| | | Irritant | Harmful | Corrosive | Oxidising | Dangerous for the environment | Highly flammable | Extremely flammable | |
| **Surface disinfection** | 478 | 192 | 18 | 131 | 5 | 60 | 21 | 1 | 124 |
| **Hand/skin disinfection** | 136 | 67 | 0 | 1 | 1 | 1 | 31 | 1 | 48 |
| **Instrument disinfection** | 182 | 41 | 22 | 96 | 0 | 32 | 2 | 0 | 23 |
| **Linen and clothing disinfection** | 32 | 17 | 7 | 18 | 9 | 2 | 0 | 0 | 10 |

The hazard symbols found indicate a broad range of hazards associated with the products. Thus, disinfectants can be:

- corrosive (C) or irritant (Xi) - in this case they have effects on the skin and mucous membranes
- harmful (Xn), with potential effects on organs
- highly flammable (F), extremely flammable (F+) or oxidising (O), which indicates a serious risk of fire
- dangerous for the environment (N), which means they should not be poured down drains.

Some disinfectants also have dangerous properties indicated by risk phrases (R phrases). Given their role in some occupational diseases [2], products carrying the following phrases in particular present problems: "may cause sensitisation by inhalation" (R42), "may cause sensitisation by skin contact" (R43) or "may cause sensitisation by inhalation and skin contact" (R42/43). Disinfectants can also be a serious risk for the eyes (R41) or be suspected carcinogens (R40).

Nevertheless, not all disinfectants present the same risks. Table 1 shows that products carrying no hazard symbol exist for each disinfection task. In addition, according to the study from which these data are taken, none of the risk phrases from R 40 to 43 apply to these products. These products therefore present the fewest risks to users. However, when comparing products, the user must rely on the information supplied by the manufacturer which can be of variable quality. In addition, the information provided is based on the available data relating to the properties of the active substances used. Thus, substances for which sufficient toxicological data are not available may not be classed or labelled simply due to a lack of data.

**NB**: From 1 June 2015, the classification and labelling of mixtures of chemical products, including commercially-available disinfectants, must conform to the European CLP regulation [3]. For pure substances, this regulation has been applied since 1 December 2010. According to the terms of these regulations, dangerous substances will be ranked in hazard classes and categories, with correspond-

ing H statements (hazard statements). A completely new set of hazard symbols will also be used. Switzerland has also adopted an adapted version of the CLP regulation.

To help with application of the CLP regulation, information is available on the Internet, in particular on the following sites:

- for Germany: www.reach-clp-helpdesk.de/de/CLP/CLP.html
- for France: http://clp-info.ineris.fr/
- for Switzerland: www.bag.admin.ch/anmeldestelle/13604/13766/index.html?lang=en

### 3. Chemical disinfection methods and associated risks

The hazards associated with disinfectants only become a risk to humans when they come into contact with a product. The risks therefore depend on the type of task performed and the procedure used.

The main routes of exposure are inhalation (respiratory tract) and skin contact (dermal exposure). Oral exposure is also possible if the hands are contaminated, or through aerosols. Fortunately, ingestion of chemical products is very rarely encountered in an occupational setting.

When disinfectants are used in an **open** system, exposure by inhalation or dermal exposure is possible. A basin of disinfectant, such as those sometimes used to disinfect instruments, contains volatile substances which can evaporate and penetrate the airways. If the hand is dipped into the solution there is dermal exposure. In addition, splashes/aerosols may be produced during handling, causing non-volatile compounds to become airborne. Thus, a risk of exposure by inhalation or through the skin exists. The same type of risks are encountered when surfaces are manually disinfected, e.g. with a wipe.

Spray disinfection produces large quantities of aerosols, which represent a significant source of inhalation exposure. The use of brushes, when cleaning is performed by brushing/wiping, can also give rise to splashes and the formation of droplets.

The potential for direct contact with the disinfectant is reduced - at least under normal usage conditions - when disinfectants are used in automatic machines, i.e., as far as possible in a **closed** system (e.g. during some procedures to disinfect endoscopes or anaesthetic tubing). These systems significantly reduce skin contact, and the intensity of inhalation exposure depends on how the vapours formed are evacuated from the system and from the room where it is located.

The activities preceding and following disinfection (attaching recipients containing the disinfectant, dilution of concentrated products, elimination of waste disinfectants and soiled utensils, interventions for repairs) can also cause inhalation or dermal exposure.

A risk of fire or explosion exists when highly or extremely flammable disinfectants are used on large surface areas in closed rooms. This is encountered specifically when surfaces are disinfected with alcohol-based disinfectants, or in case of skin disinfection prior to the use of electrosurgical devices or lasers.

Disinfection tasks can be associated with prolonged “wet work” (working in a wet environment), whether due to permanent contact between the skin and water, or because waterproof gloves are worn. This type of activity damages the skin and can lead to skin diseases and disorders.

### 4. Determining exposure to disinfectants

To assess the risks linked to chemical disinfectants the level of exposure through the skin and airways must be determined. The employer must answer the following questions:

- What disinfectants (products, ingredients) are used and what procedures are implemented for a given disinfection task?

- Does this operation involve a risk of contact with the concentrated disinfectant or the working solution?
- How much liquid presenting risks for the skin is used? Is this volume measured in cubic centimetres ($cm^3$), litres (l) or cubic metres ($m^3$)?
- How long does the task last? In Germany, a distinction is made between tasks lasting more than 15 min and those lasting less than 15 min.
- With what frequency is this task performed?
- Does skin contact involve a large area of skin or is it due to splashes?
- What parts of the body and areas of skin are likely to be affected?
- What concentration is the disinfectant used at (dilution procedure)? Are steps taken to ensure correct dosage?
- How is the solution prepared prior to the disinfection task?
- Does the concentrated product or the working solution contain substances that are volatile at the temperature of use?
- Is there an occupational exposure limit value for airborne components?
- Does the disinfection method involve an open system from which substances may evaporate?
- Can aerosols be formed during disinfection?
- Are the workers constantly close to the source of disinfectant, or do they move about freely in the room?
- Is the area where the disinfectant is used fitted with ventilation, and what is the flow rate ($m^3/h$)?
- Is the area naturally ventilated, and is the ventilation rate known ($m^3/h$)?
- How long are the workers (or other people) present in the area?

The answers to these questions can be used to assess exposure linked to specific disinfection tasks, and to develop appropriate preventive measures.

Various methods can be used to assess the level of exposure:

- A qualitative assessment can be performed by experts familiar with disinfection methods and exposure assessment during disinfection tasks (e.g. OSH professionals, occupational hygienists, occupational physicians). Manufacturers are also aware of the usage conditions and the exposure risks associated with their products (see material safety data-sheets and manufacturer's information).
- When the factors determining exposure (answers to the questions above) are known, the literature can be searched for data on exposure levels during disinfection tasks. For conclusions to be drawn from this bibliographic study, the real situation and the situation described in the literature must be sufficiently similar. Guides published by professional bodies and occupational health and safety institutions are often precious tools in this situation (e.g. [4]).
- If precise elements to assess exposure are not available from experts or the literature, measurements can be made, in particular to determine levels of airborne compounds. There are currently no routine methods available to quantify dermal exposure, but the information mentioned above can be used for indicative assessment of exposure.
- Personal or stationary sampling methods are often the best way to determine airborne concentrations, providing precise information on exposure while the measurements are made. In addition, many standards indicate measurement as an appropriate method to determine exposure. However, measurement is both difficult and costly, and it must be remembered that the relevance of isolated measurements is limited, as it only allows the situation to be assessed at

a given time, generally not taking variations over time (depending on the day, the week, the season) into account.

This drawback can be overcome by using mathematical models to describe exposure scenarios. The most precise and complex models take variations in exposure into account. These models rely on measurement data and on information on the working environment and conditions. The better the workstation corresponds to the conditions of the chosen model, the closer the values supplied by the model will be to the real exposure values.

With this list of methods, it becomes clear that exposure can only be correctly determined by those with specific skills, and that not everyone has the competencies required to do this. Taking measurements, in particular, and modelling can only be performed by experienced, competent personnel whose role is to help employers to fulfil their obligations in terms of occupational risk prevention. The national guidelines for determining exposure by inhalation and through the skin should also be taken into account. In Germany, for example, TRGS 400 to 402 apply [5, 6, 7].

### 5. Principles for evaluating chemical exposure

Often, data on exposure can only be qualitatively interpreted, as only some of the ingredients in disinfectants have an occupational exposure limit (OEL) which can be used for quantitative assessment. In addition, no limit values have been established for dermal exposure.

For some active substances, **atmospheric concentration** can be assessed based on the OEL. A search for atmospheric exposure limit values for the 63 most common ingredients in disinfectants shows 17 substances which have limit values in Germany, France, Switzerland or other countries (Denmark, Sweden, etc.) (Table 2). This information is taken from the international limit values list published by DGUV, in Germany, in its GESTIS information system on dangerous substances [8].

**Table 2:** Ingredients in disinfectants with an occupational exposure limit value in France, Switzerland or Germany, and for some in Denmark or Sweden (source: "Liste Internationaler Grenzwerte" of the “Gefahrstoffinformationssystem GESTIS” of the German DGUV, as of August 2013). Values shown [mg/m$^3$] are per shift / for short exposure times.

| CAS No. | Compound | Germany | France | Switzerland | Other countries |
|---|---|---|---|---|---|
| 50-00-0 | Formaldehyde | -/- | 0.5/1 ppm | 0.37/0.74 | |
| 59-50-7 | 4-Chloro-3-methylphenol | -/- | -/- | -/- | 3/6 Sweden |
| 67-63-0 | 2-Propanol | 500/1000 | -/980 | 500/1000 | |
| 64-17-5 | Ethanol | 960/1920 | 1900/9500 | 960/1920 | |
| 64-19-7 | Acetic acid | 25/50 | -/25 | 25/50 | |
| 71-23-8 | 1-Propanol | -/- | 500/- | 500/- | |
| 107-22-2 | Glyoxal | -/- | -/- | -/- | 0.5/0.5 Denmark<br>0.1/- Belgium, Canada-Ontario, Spain |
| 107-21-1 | Ethanediol | 26/52 | 52/104 | 26/52 | |
| 110-63-4 | 1,4-Butanediol | 200/800 | -/- | -/- | |
| 110-85-0 | Piperazine | 0.1/0.1 | 0.1/0.3 | -/- | |
| 111-30-8 | Glutaraldehyde | 0.2/0.4 | 0.4/0.8 | 0.21/0.42 | |
| 112-34-5 | 2-(2-Butoxyethoxy) ethanol | 67/100 | 67.5/101.2 | 67/101.2 | |
| 122-99-6 | 2-Phenoxyethanol | 110/220 | -/- | 110/220 | |
| 141-43-5 | Ethanolamine | 5.1/10.2 | 2.5/7.6 | 5/10 | |
| 1310-58-3 | Potassium hydroxide | -/- | -/2 | 2(inhalable aerosol)/- | |
| 1310-73-2 | Sodium hydroxide | -/- | 2/- | 2(inhalable aerosol) / 2(inhalable aerosol) | |
| 7722-84-1 | Hydrogen peroxide | -/- | 1.5/- | 0.71/0.71 | |

The 17 substances listed in Table 2 have an airborne limit value; in contrast, almost 200 of the substances identified during analysis of the German market [1] have no limit value. Thus, the majority of ingredients do not have a limit value. Not all of these ingredients are volatile, making it less likely that they enter the respiratory tract if they are used appropriately. These 200 substances are used with variable frequency in disinfectants. Nevertheless, many substances with a limit value are among the most commonly used volatile ingredients in disinfectants.

The German technical rules for dangerous substances (TRGS 401) suggest classing **dermal risks** in three categories corresponding to a low, moderate or high risk, due to the ingredients in disinfectants. These categories are determined based on the disinfectant's hazard profile, the extent of skin contact and the duration of disinfection tasks. The criteria used for this classification are shown in Table 3.

**Table 3:** Hazard categories determined based on the mode of dermal exposure (adapted from TRGS 401). l = low risk; m = moderate risk; h = high risk.

| Activities/substances | | Duration/extent of skin contact | | | |
|---|---|---|---|---|---|
| | | Short term (< 15 minutes) | | Longer term (> 15 minutes) | |
| | | Small area (splashes) | Large area | Small area (splashes) | Large area |
| Dangerous for the skin | pH < 2/pH > 11.5 | m | m | m | H |
| | R 34 | m | m | m | H |
| | R 35 | m | h | h | H |
| | R 38 | l | m | m | M |
| | R 66 | l | l | l | M |
| Dermal absorption and other properties | R 21 | l | m | m | H |
| | R 24 | m | m | m | H |
| | R 27 | h | h | h | H |
| | R 24 in combination with R 34 or R 35 | h | h | h | H |
| | R 40, R 68 | m | m | m | H |
| | R 62, R 63 | m | m | m | M |
| | R 45, R 46, R 60, R 61 | h | h | h | H |
| Sensitising | R 43 | l | m | m | H |

**R phrases mentioned in the table:**

| | |
|---|---|
| **R 21** | Harmful in contact with the skin |
| **R 24** | Toxic in contact with the skin |
| **R 27** | Very toxic in contact with the skin |
| **R 34** | Causes burns |
| **R 35** | Causes severe burns |
| **R 38** | Irritating to skin |
| **R 40** | Suspected carcinogen |
| **R 43** | May cause sensitisation by skin contact |
| **R 45** | May cause cancer |
| **R 46** | May cause heritable genetic damage |
| **R 60** | May impair fertility |
| **R 61** | May cause harm to the unborn child |
| **R 62** | Possible risk of impaired fertility |
| **R 63** | Possible risk of harm to the unborn child |
| **R 66** | Repeated exposure may cause skin dryness or cracking |
| **R 68** | Possible risk of irreversible effects |

The preventive measures applied should be appropriate for the risks encountered, the area of skin exposed, and the duration of activity involved. When the risk is low, general good hygiene is sufficient. If a moderate risk is identified, substitution should be examined, and workers should wear protective gloves, use products to protect and care for the skin and, if necessary, undergo a preventive occupational medical examination, in line with national regulations. Procedures presenting a high risk should be carefully assessed to determine their necessity, and a closed system should be used where possible.

The classification applicable from July 2015 based on the European CLP regulation is presented at the end of this factsheet (a Annex, parts 1 to 3).

When assessing exposure at the workstation, it is always important to investigate whether the risks associated with a disinfection task can be diminished by reducing the intrinsic risks linked to the disinfectant, and avoiding its use in an open system. Selecting the safest disinfectants (from the point of view of occupational risk prevention) thus occupies a central position in risk reduction (a see Factsheets 1 and 4).

#### 6. Preventive measures (STOP)

If, during risk assessment, the employer observes risks linked to disinfection tasks and the disinfectants used, appropriate preventive measures must be applied. The hierarchy of preventive measures is defined in the regulations [9], and can be summarised with the four letters of the word STOP:

- S - Substitution of the products or procedures used
- T - Technical preventive measures
- O - Organisational measures
- P - Personal protective measures

**Substitution:** Potential product substitution can only be analysed by those with a good knowledge of the methods used or products available on the market. This will help to optimise selection of the replacement procedure. For further details, see factsheet 4 (a Factsheet 4: Selecting safe disinfectants).

**Technical preventive measures** can be of various types:

- (Automated or semi-automated) installations where treatment is performed in a closed system as far as possible
- Technical aides to reduce contact between the worker and the disinfectant (e.g. dosing devices)
- Systems to eliminate the chemicals present in the atmosphere surrounding work zones (in particular, localised aspiration, ventilation).

When it is necessary to use substances which are known skin or respiratory sensitisers, an automated system must be used. Skin contact and aerosols must be avoided at all times during handling of concentrated disinfectants; e.g. for dilution. If the product may evaporate, or if the ingredients in the disinfectant can be rendered airborne in any other way, ventilation should be adapted to eliminate these emissions as rapidly as possible from the workers' breathing zone.

**Organisational aspects** contribute to protecting workers from the risks associated with disinfectants. Disinfection tasks must involve as few workers as possible. It is also important to try to avoid prolonged wet work due to the effects on the skin. The associated tasks before and after disinfection should be performed in rooms where conditions are appropriate (in particular, with adequate ventilation). Waste elimination should conform to the applicable regulations.

Training and informing personnel (which can include usage advice and describing existing procedures) can also be part of prevention; sessions should be organised at regular intervals.

**Personal protective measures** include wearing

gloves, protective clothing and masks. These should be used when, despite technical and organisational steps, a disinfection task continues to represent risks for workers' health and safety.

Protective gloves to protect against chemicals should conform to standard EN 374, parts 1-3. Through their shape and composition, they should be waterproof and sufficiently resistant to the ingredients in the disinfectants.

The same applies to protective clothing which may come into contact with chemical products. This clothing should conform to standards EN ISO 6529, EN 463 and EN 468.

Respiratory masks are only required when using disinfectants containing aldehydes (terminal disinfection with a high concentration of formaldehyde, glutaraldehyde, etc.). Masks should conform to European standards (in particular, EN 132 to EN 149) and to the applicable national regulations.

In addition to the personal protective equipment (PPE) indicated above, some disinfection tasks may require additional protective equipment. For example, when corrosive substances (acids) are used, protective glasses or a face-mask may be necessary.

Personal protective equipment should never be used permanently. It should only be used for short durations in the absence of, or while waiting for, better preventive measures (technical and organisational).

**7. Monitoring preventive measures**

The preventive measures selected should protect workers from the harmful effects of disinfectants. For this protection to be constant, it is important to regularly verify the efficacy of the measures implemented.

When performing checks, it is wiser to ensure that ventilation systems (local exhaust ventilation or general ventilation) function correctly than to measure the atmospheric concentration of the various ingredients in the disinfectants. It is also important to check whether the methods used and the conditions which led to implementing a given preventive measure (frequency of the task, disinfectant concentration, room configuration etc.) still apply. Correct use of personal protective equipment should also be verified.

**8. Information and personnel training**

Workers performing disinfection tasks must be provided with training on the risks and applicable preventive measures (including with regard to sensitising substances and "wet work"). Training should be adapted to the nature of the risks identified in the company and be delivered before work is started, and renewed as necessary, for example, at least once a year, orally and in an appropriate form for each workstation. When the risks justify it, the contents and periodicity of training should be set out in writing. Trainees should also provide written confirmation that they have received this training.

In many cases, written information should be provided to advise on usage or work procedures, e.g. describing the human and environmental risks associated with a disinfection task, and the applicable preventive measures as well as appropriate behaviour rules. This should also be provided for risks linked to wet work. The advice should be presented in a comprehensible style, using appropriate language, and should be posted in a visible position in the rooms where disinfection or related tasks will be performed.

The employer should encourage workers to indicate any specific health hazards and to suggest relevant preventive measures.

**9. Medical surveillance**

No specific medical surveillance is necessary for workers using disinfectants. Like all workers, they should, nevertheless, be monitored. During medical examinations, the risks for the skin and respiratory tract linked to the use of disinfectants should

be discussed, the products used should be noted, along with the organisational methods implemented, the extent of the disinfection activities and whether preventive measures are correctly applied, including the use of skin-protective products.

Medical surveillance should be performed at regular intervals, in line with the applicable national regulations.

In Germany obligatory medical examinations must be conducted for those who perform wet work for more than 4 hours per day, and when products presenting risks for the skin with a potential high hazard rating, according to TRGS 401, are used.

## References


[1] Eickmann U, Knauff-Eickmann R, Seitz M. Desinfektionsmittel im Gesundheitsdienst – Stand 2010. Gefahrstoffe – Reinhaltung der Luft 2011; 71(9): 393-396.

[2] Arif AA, Delclos GL, Serra C. Occupational exposures and asthma among nursing professionals. Occup Environ Med 2009;66: 274-278.

[3] Regulation (ec) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

[4] European Commission. Occupational health and safety risks in the healthcare sector. Guide to prevention and good practice. Luxembourg, Publications Office of the European Union 2011, 275 pages, ISBN 978-92-79-19454-2.

[5] Technical Rule for Hazardous Substances 400 (TRGS 400), Risk assessment for activities involving hazardous substances, BAuA, December 2010. Available: www.baua.de.

[6] Technical Rule for Hazardous Substances 401 (TRGS 401), Risks resulting from skin contact - determination, evaluation, measures, BAuA, May 2006.Available: www.baua.de.

[7] Technical Rule for Hazardous Substances 402 (TRGS 402), Identification and Assessment of the Risks from Activities involving Hazardous Substances: Inhalation Exposure, BAuA, January 2010. Available: www.baua.de.

[8] GESTIS, DGUV information system on dangerous substances [GESTIS-Stoffdatenbank], English version: http://www.dguv.de/ifa/Gefahrstoffdatenbanken/GESTIS-Stoffdatenbank/index-2.jsp

[9] Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work (fourteenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC).

## Annex, Part 1: Assessing risks linked to skin contact with chemicals based on their labelling according to the CLP regulation*

| Property | Hazard class / category | Hazard statement code on compound label | Duration/extent of skin contact | | | |
|---|---|---|---|---|---|---|
| | | | Short term (< 15 minutes) | | Longer term (> 15 minutes) | |
| | | | Small area (e.g. splashes) | Significant area | Small area (e.g. splashes) | Significant area |
| | - | EUH 066 | l | L | l | M |
| **Skin irritant** | Skin irritant Cat. 2 | H 315 | l | M | m | M |
| **Corrosive to skin** | pH ≤ 2 and pH ≥ 11.5; corrosive to skin, Cat. 1A, 1B, 1C | H 314 | m | M | m | H |
| **Dermal absorption** | Acute toxicity (through skin contact) Cat. 4 | H 312 | l | M | m | H |
| | Acute toxicity (through skin contact) Cat. 3 | H 311 | m | M | m | H |
| | Acute toxicity (through skin contact) Cat. 2 or 1 | H 310 | h | H | h | H |
| **Dermal absorption and corrosive to skin** | Acute toxicity (through skin contact) Cat. 3 + corrosive to skin, Cat. 1A, 1B, 1C | H 311 and H 314 | h | H | h | H |
| **Dermal absorption with other properties** | Carcinogenic Cat. 2 Mutagenic Cat. 2 | H 351H 341 | m | M | m | H |
| | Reprotoxic Cat. 2 | H361 | m | M | m | M |
| | Carcinogenic Cat. 1A, 1B Mutagenic Cat. 1A, 1B Reprotoxic Cat. 1A, 1B | H 350 H 340 H 360 | h | H | h | H |
| **Sensitising** | Skin sens. Cat.1 | H 317 | l | M | m | H |
| | Sensitising products according to annex 3 or paragraphs 2 or 3 of section 3.2.1 of the German TRGS 401 | | | | | |

l = low risk m = moderate risk h = high risk

* Source: „Gefährdungsbeurteilung der dermalen Exposition für Stoffe nach der CLP- Verordnung“ (Assessing risks linked to skin contact with chemicals based on the CLP regulation, in German), see: www.dguv.de

**Annex, Part 2: Assessing risks linked to skin contact with chemicals in the "specific target organ toxicity (STOT)" hazard category defined by the CLP regulation**

| Property | Hazard class/ category | Hazard statement code on label | Duration/extent of skin contact | | | |
|---|---|---|---|---|---|---|
| | | | Short term (< 15 minutes) | | Longer term (> 15 minutes) | |
| | | | Small area (e.g. splashes) | Significant area | Small area (e.g. splashes) | Significant area |
| Dermal absorption with other properties | STOT, single exposure, Cat. 2 | H 371 | l | m | m | h |
| | STOT, single exposure, Cat. 1 | H 370 | m | m | m | h |
| | STOT, repeated exposure, Cat. 2 | H 373 | l | m | m | h |
| | STOT, repeated exposure, Cat. 1 | H 372 | m | m | m | h |

l = low risk m = moderate risk h = high risk

For the classification based on the hazard classes and categories in the CLP regulation, only the criteria related to dermal exposure are taken into account in the table above (see the table below for equivalences between Directive 67/548/EEC and the classes and categories in the CLP regulation [STOT]).

| Health risk | Directive 67/548/EEC | | | CLP regulation | | |
|---|---|---|---|---|---|---|
| | Hazard category | R phrase | Classification criteria | Hazard class and category | H statement | Classification criteria |
| Specific target organ toxicity, single exposure | Highly toxic, T+ | R 39/27 | $DL_{50} \leq 50$ mg/kg | STOT Single exposure, Cat. 1 | H 370 | $DL_{50} \leq 1000$ mg/kg |
| | Toxic, T | R 39/24 | $50 < DL_{50} \leq 400$ mg/kg | | | |
| | Harmful, Xn | R 68/21 | $400 < DL_{50} \leq 2000$ mg/kg | STOT, Single exposure, Cat. 2 | H 371 | $1000 < DL_{50} \leq 2000$ mg/kg |
| Specific target organ toxicity, repeated exposure | Toxic, T | R 48/24 | $DL_{50} \leq 10$ mg/kg | STOT, Repeated exposure, Cat. 1 | H 372 | $DL_{50} \leq 20$ mg/kg |
| | Harmful, Xn | R 48/21 | $10 < DL_{50} \leq 100$ mg/kg | STOT, Repeated exposure, Cat. 2 | H 373 | $20 < DL_{50} \leq 200$ mg/kg |

## Annex, Part 3: Classification of the hazards linked to skin contact with chemicals, according to the CLP regulation

| **A. H and EUH phrases corresponding to substances with effects on skin:** | | | |
|---|---|---|---|
| **H statement** | **Wording** | **Signal word** | **Equivalent to the following R phrase** |
| H 310 | Fatal in contact with skin | Danger | R 27 |
| H 311 | Toxic in contact with skin | Danger | R 24 |
| H 312 | Harmful in contact with skin | Warning | R 21 |
| H 314 | Causes severe skin burns and eye damage (sub-categories of skin burns 1B, 1C) | Danger | R34 |
| H 314 | Causes severe skin burns and eye damage (sub-categories of skin burns 1A) | Danger | R 35 |
| H 315 | Causes skin irritation | Warning | R 38 |
| H 317 | May cause an allergic skin reaction | Warning | R 43 |
| EUH 066 | Repeated exposure may cause skin dryness or cracking | *No signal word* | R 66 |
| **B. Other H statements corresponding to compounds which also have dermal absorption properties and which are, according to the regulations, H classed:** | | | |
| **H statement code** | **Wording** | **Signal word** | **Equivalent to the following R phrase** |
| H 340* | May cause genetic defects | Danger | R 46 |
| H 341* | Suspected of causing genetic defects | Warning | R 68 |
| H 350* | May cause cancer | Danger | R 45 |
| H 351* | Suspected of causing cancer | Warning | R 40 |
| H 360* | May damage fertility or the unborn child | Danger | R 60, R 61 |
| H 361* | Suspected of damaging fertility or the unborn child | Warning | R 62, R 63 |
| H 370* | Causes damage to organs | Danger | R 39 |
| H 371* | May cause damage to organs | Warning | R 68 |
| H 372* | Causes damage to organs through prolonged or repeated exposure | Danger | R 48 |
| H 373* | May cause damage to organs through prolonged or repeated exposure | Warning | R 48 |
| * Classification based on the "skin contact" route of exposure | | | |

## Use of disinfectants in the health care sector: Chemical hazards and preventive measures

**Factsheet 2: General principles of prevention**

12/2014


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