

Chemical Agents

Toolbox Talk



In general chemical substances in any form may be hazardous to health should the exposure exceed certain limits. Therefore, conducting measurements to assess the employee exposure to chemicals is a **MUST**. Chemical substances may be found in the following forms:

- Gases
- Vapors
- Dusts
- Fibres
- Fumes-smokes
- Mists
- Liquids
- Solids

Chemicals are everywhere but there are cases where the risks are higher. The commonest pollution sources are:

- Combustions
- Construction materials
- Smoking
- Chemical substances
- Appliances
- Machinery
- Human activity
- External air

Exposure to a chemical agent is defined as the individual exposure level of the worker to a chemical agent that is present in the workplace air.

The chemical agent may be in the form of gas, steam or suspended particles.

The exposure level refers to the **concentration** of the chemical agent to which a worker is exposed **over a certain period of time** and its value is expressed in parts of vapor or gas volume per million parts of air volume (ppm) or in milligrams of chemical agent per cubic meter of air (mg/m³). In case of fiber particles it can be expressed in number of fibers per unit of air volume.

Chemical exposure limit value: the value that may not be exceeded during an average 8-hour time-weighted exposure to the chemical agent (i.e. a shift), measured in the area of the breathing zone or a 40-hour weekly work.

Maximum exposure limit for a chemical agent: the value that may not be exceeded during any 15-minute time-weighted exposure period during the shift to the chemical agent, measured in the area of the breathing zone, even if the previous exposure limit value is not violated.

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CA 3	NAME OF AGENT	LIMIT VALUES				Notation
		8 hours		Short term		
		mg/m ³	ppm	mg/m ³	ppm	
68-12-2	N,N-Dimethylformamide	15	5	30	10	skin
75-15-0	Carbon disulphide	15	5	—	—	skin
80-05-7	Bisphenol A (inhalable dust)	10	—	—	—	—
80-62-6	Methyl methacrylate	—	50	—	100	—
96-33-3	Methylacrylate	18	5	36	10	—
108-05-4	Vinyl acetate	17,6	5	35,2	10	—
108-95-2	Phenol	8	2	16	4	skin

Exposure limit values

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109-86-4	2-Methoxyethanol	—	1	—	—	skin
110-49-6	2-Methoxyethyl acetate	—	1	—	—	skin
110-80-5	2-Ethoxy ethanol	8	2	—	—	skin
111-15-9	2-Ethoxyethyl acetate	11	2	—	—	skin
123-81-1	1,4 Dioxane	73	20	—	—	—

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109-86-4	2-Methoxyethanol	—	1	—	—	skin
110-49-6	2-Methoxyethyl acetate	—	1	—	—	skin
110-80-5	2-Ethoxy ethanol	8	2	—	—	skin
111-15-9	2-Ethoxyethyl acetate	11	2	—	—	skin
123-81-1	1,4 Dioxane	73	20	—	—	—
140-88-5	Ethylacrylate	21	5	42	10	—
524-83-9	Methylisocyanate	—	—	—	0,02	—
872-50-4	n-Methyl-2-pyrrolidone	40	10	80	20	skin
1634-04-4	Tertiary-butylmethyl ether	183,5	50	367	100	—
	Mercury and divalent inorganic mercury compounds including mercuric oxide and mercuric chloride (measured as mercury)	0,02	—	—	—	—
7664-93-9	Sulphuric acid (mist)	0,05	—	—	—	—
7783-06-4	Hydrogen sulphide	7	5	14	10	—

Exposure limit values

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- (1) CAS: Chemical Abstract Service Registry Number.
- (2) A skin notation assigned to the occupational exposure limit value indicates the possibility of significant uptake through the skin.
- (3) Measured or calculated in relation to a reference period of 8 hours time-weighted average (TWA).
- (4) Short-term exposure limit (STEL). A limit value above which exposure should not occur and which is related to a 15-minute period unless otherwise specified.
- (5) mg/m^3 : milligrams per cubic metre of air at 20 °C and 101,3 KPa.
- (6) ppm: parts per million by volume in air (ml/m^3).
- (7) During exposure monitoring for mercury and its divalent inorganic compounds, account should be taken of relevant biological monitoring techniques that complement the IOELV.
- (8) When selecting an appropriate exposure monitoring method, account should be taken of potential limitations and interferences that may arise in the presence of other sulphur compounds.
- (9) The mist is defined as the thoracic fraction.

For total volatile organic compounds (TVOCs) concentrations, there is no established limit in the international specifications because many different compounds are involved, and each one of them is harmful to a different concentration than the others. Consequently, the concentration of these compounds should be as low as possible. The ECA (European Concerted Action) and according to studies propose the following classification depending on the effects that they may cause on human health.

Total concentration	Discomfort and irritation	Exposure Scale
<0,2 mg/m ³	No irritation or discomfort	Comfort scale
0,2 – 3,0 mg/m ³	Possible irritation or discomfort according to the interaction with other factors	Exposure scale in many factors
3,0 – 25 mg/m ³	Symptoms - Possible appearance of headache depending on the effect of other factors	Discomfort scale
>25 mg/m ³	Additional neurotoxic effects (in addition to headache) may occur	Toxic exposure scale

Asbestos: DIRECTIVE 2009/148/EC

Employers shall ensure that no worker is exposed to an atmosphere with an asbestos content of more than 0.1 fibers per cm³ as a time-weighted average of 8 hours (TWA).

- Recording the characteristics of the work environment (building, space, etc.)
- Collection of data on workers' reaction to environmental conditions and possible symptoms by using standardized questionnaires
- Measurements of the most important factors affecting workplaces.

Area characteristics

- **General area characteristics**
orientation, area, use, contact with external environment, external sources of pollution, building materials, age, geometric characteristics, incoming activities, equipment, appliances, cleaning, cleaning products etc.
- **Area electromechanical facilities**
mechanical ventilation, heating and cooling systems, air recirculation and humidification system, filters, frequency ventilation cleaning and maintenance, etc.
- **Area where the measurements will take place** surface, opening, equipment, devices, building materials, materials used etc.
- **External environmental conditions** ambient temperature, relative humidity, weather conditions

Harmful factors measurements

Preliminary examination

- Data collection (older measurements)
- Specific measurements

Measurement strategy

- Selection of factors to be measured
- Selection of suitable methodology and measuring instruments
- Discussion with the responsible scientists for the determination of the specific time and place of the measurements
- Selection of the appropriate employees

Conducting measurements – recording the conditions

Harmful factors measurements

Results

- Recording and evaluating the results
- Comparing the results with the corresponding limit values
- Conclusions
- Proposals to reduce the exposure

Action planning for measurements repetition

- Choice of approved methods
- Instrument maintenance and calibration
- Selection of ISO 17025 accredited laboratories in these fields should the results be analyzed at a laboratory
- Comparison of results with legislative limits and proposals based on other directives.

Determination of chemical agents

Direct identification

- Automatic instruments for direct reading or continuous recording (e.g., suspended particles, organic chemical agents, explosive gases)



Determination of chemical agents

Direct identification

- Reaction dye tubes (color change upon reaction of filler with the identified agent)



Active method using a pump



Passive method without the use of a pump

Determination of chemical factors

Analytical technique

- Step 1: **Taking sample**

- Pumps



- Sampling heads and filters



- Tubes with absorbent material



- Step 2: Laboratory analysis using specific techniques (eg, chromatography, spectrophotometry, atomic absorption, plasma spectroscopy)