

## Minimising formaldehyde exposure through substitution of resins

**Country:** Slovenia.

**Available language:** English.

The **sector covered** in this case study is manufacture of glass fibres.

**Task covered:** manufacturing.

**Worker groups** covered (vulnerable groups): all workers (no specific groups).

The **purpose of this example of good practice** was to act on risk assessment carried out in accordance with REACH and CLP.

The **target groups** are managers and OSH consultants.

### 1 Initiator/organisations involved

Ursa Slovenija d.o.o.

### 2 Description of the case

#### 2.1 Introduction/background

**Biological agents:** none.

**Hazard — health effect:** carcinogens, mutagens, skin sensitisers, irritants.

**Hazard — physical state:** vapours.

**Exposure route:** inhalation.

**Substance description (CAS/EC) (only if possible):** formaldehyde (50-00-0/200-001-8).

Ursa Slovenija d.o.o. manufactures insulation products using mineral glass wool. It is a subsidiary of the Ursa Group, which operates plants that manufacture insulation products throughout Europe. Ursa Slovenia employs 120 staff, of whom about two-thirds work in production and maintenance and one-third are white-collar staff.

The production of mineral glass wool is a process that requires the preparation of a mixture of quartz sand and recycled waste glass. In the production process, binders and various additives are introduced to the mixture, for example to make the fibres water-repellent and biodegradable. First, the mixture is melted in a glass furnace at a temperature of about 1,300 °C. The melt is then poured into a rotor, where the mixture is spun into fibres. A binder is added to consolidate the mixture into the finished product. Finally, the product is cut and packaged.

One of the substances added to the binder is free formaldehyde. The free formaldehyde is supplied as a 6-8 % weight fraction of phenol-formaldehyde (PF) resins; it is stored in a special reservoir and then piped into a mixing vessel, where the phenol-formaldehyde-urea binder is prepared. Formaldehyde is an essential component in the production of urea-formaldehyde (UF) resins and PF resins. It is a cross-linking agent that initiates the polymerisation of UF and PF resins. PF and UF resins are used in several industries in various formulations, for example in the manufacturing of plywood, carpeting, mineral wool and electrical components. The mechanical and other properties of these resins mean that they cannot always be replaced with other binding or adhesive materials, in particular on account of their high thermal resistance (in the case of PF resins) and low price (in the case of UF resins).

In Slovenia, the binding occupational exposure limit value for 8 hours' exposure to formaldehyde is 0.62 mg/m<sup>3</sup>, and this remained unchanged after 2016 when formaldehyde was classified as a category 1B carcinogen. In 2016, the European Commission's Union's Scientific Committee on Occupational Exposure Limits recommended a 0.37-mg/m<sup>3</sup> (0.3-ppm) 8-hour time-weighted average exposure limit value for formaldehyde. In places where workers could be exposed, levels of formaldehyde are regularly measured. In Ursa Slovenija, the formaldehyde level was at its highest in one of the production chambers, where it peaked at approximately 20 % of the limit value. Elsewhere, it was below 10 % of the limit value.

Since 1 January 2016, formaldehyde has been officially classified as a category 1B carcinogen at the EU level, and this applies also to Member States.

## 2.2 Aims

When formaldehyde was classified as a category 1B carcinogens by the Classification, Labelling and Packaging (CLP) Regulation, the company checked where exactly use of and exposure to formaldehyde could be identified in the factory (e.g. preparation of the mixture, production, dealing with final products). The company considered whether or not new or additional measures were needed to safeguard the health of workers and of people living in the surrounding area, and to protect the environment.

The company's goal was to remove formaldehyde from the production process or to bring it below the level at which it is considered dangerous, thus providing a healthier work environment, as well as protecting the environment. According to the CLP Regulation, mixtures with a concentration of formaldehyde below 0.1 % are not classified as category 1B carcinogens or as having other dangerous properties linked to formaldehyde.

## 2.3 What was done and how?

Since the addition of formaldehyde to the list of category 1B carcinogens, several measures have been taken to review the existing situation and take the necessary measures to comply with the new requirements.

### 2.3.1 Initial assessment and measures

- All the existing legislation and requirements relating to the new classification of formaldehyde were examined, to check what new or additional measures would need to be implemented as a result.
- Because of the use of carcinogens, the authorised practitioner of occupational medicine for the company was also acquainted with the changes in the formaldehyde classification and assured that special health surveillance of workers had been initiated (including recording of workers' medical and work histories, personal interviews with workers and monitoring the present physical condition of workers; however, no biological monitoring was carried out because no method for this is available for formaldehyde). It was established that about 30 workers could come into contact with formaldehyde.
- New measurements of formaldehyde were taken in all places where, based on experience, it was assumed that formaldehyde could be present.
- All places where the presence of formaldehyde was detected were indicated by signs warning against the danger of formaldehyde (Figure 1).
- Special consultation and training on the hazards posed by working with formaldehyde as a carcinogenic substance was carried out with all workers who might come into contact with formaldehyde.
- All workers who might come into contact with formaldehyde were provided with adequate personal protective equipment (gloves and respiratory and eye protection).

Figure 1. Warning sign with the following safety warnings and instructions: 'Avoid inhalation, contact with skin, ingestion', 'The use of safety gloves and glasses is obligatory', 'Entry is permitted only for trained personnel'.



### 2.3.2 Examination of alternatives

The company expert could not find a substitute for formaldehyde because there was no suitable alternative for PF resins, given their good mechanical properties and thermal and water resistance. Non-formaldehyde resins available on the market are much more expensive, have less suitable mechanical properties or are not water-based. Therefore, the elimination of formaldehyde was not an option.

### 2.3.3 Adoption of specific measures

- Suppliers of formaldehyde were asked if they could supply liquid resins with such a low formaldehyde content that they would no longer be classified as hazardous substances.
- Tests of phenolic resins with less than 0.1 % formaldehyde content were carried out to determine if such solutions could be used and still achieve the desired product quality. Testing with resins containing less than 0.1 % formaldehyde showed that they could be used and that the quality of the product would not deteriorate.
- New formulations or modifications of existing formulations also required changes in the input raw materials, and these became slightly more expensive. As a consequence, the cost of the raw materials increased by less than 5 %.
- More logistical capacity was needed, since it was necessary to add larger volumes of resins because of the lower formaldehyde content.
- The addition of biocides to the mixture became necessary, since, without formaldehyde, the water used in the production process is biologically active (resulting in the formation of coatings in pipes and the clogging of chambers).

### 2.3.4 External audits

- Measurements of the formaldehyde air concentration in places where workers could be exposed to formaldehyde are carried out annually.

## 2.4 What was achieved?

Improvement could be detected on every level: regulatory administration, occupational safety and health, environmental protection and even product quality.

- The resins — now containing less than 0.1 % formaldehyde — are no longer defined as carcinogenic substances under the legal criteria.

- Workplace exposure levels were halved. Measurements of formaldehyde in the workplace showed that levels had decreased to concentrations below 10 % of the limit value. However, even before the measures were implemented, levels had been at their highest 20 % of the limit value. Exposure levels are well within the binding national and the latest recommended European occupational exposure limits.
- Formaldehyde emissions into the environment (emissions into the air from production) decreased tenfold.
- The quality of the product increased: measurements of the formaldehyde release from the product showed that, after 28 days, it complied with relevant standards relating to the release of hazardous substances from the product (meeting Blue Angel and GOLD Eurofins certification standards).

## 2.5 Problems faced

To use a resins with very low formaldehyde values, recipe modifications and minor process adjustments were required:

- More logistical capacity was needed, since it was necessary to add larger volumes of resins because of the lower formaldehyde content.
- The formation of coatings in pipes had to be addressed.
- The clogging of the chambers had to be overcome.

## 2.6 Success factors and challenges

The following factors contributed to the success the measure:

- the commitment of management to minimising the use of carcinogens in the production process;
- the ability of the engineers to modify the recipes;
- market pressure to use non-hazardous raw materials of natural origin in production.

## 2.7 Transferability

The process of replacing a dangerous substance with a less dangerous or non-hazardous substance in this industry is necessary, but the steps adopted may not be fully transferrable to other industries. For example, substitution of raw materials can also be performed elsewhere, but some of the other steps may not be applicable. However, the concept of minimising the use of dangerous substances by modifying production technology should be investigated in any enterprise.

In sectors where formaldehyde is used, such as the production of glass and mineral wool and the metal and plastics industries, such substitutions are possible and can be expected to take place in the years to come. In the future, a trend towards a transition to even safer and more environmentally friendly materials based on natural raw materials is expected. For that reason, a next step could be the use of bio-resins as adhesives; these could partly or totally replace PF and UF resins.

## 2.8 Costs and/or economic impacts

The costs of the raw materials increased by less than 5 %. More logistical capacity was needed, since it was necessary to add larger volumes of resins because of the lower formaldehyde content.

## 2.9 Evaluation

The case study:

- is transferable to other companies/sectors/countries;
- focuses where possible on preventing risk at source;
- comes from a credible source;

- does not include/contain advertising;
- involves a realistic work situation;
- provides a contact for further information.

## 2.10 Further information

### Contact

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About Ursa Slovenia: [www.ursa.si](http://www.ursa.si)

## 3 References and resources

Reports on measurements of chemicals in Ursa Slovenija (for 2011, 2014, 2017).

Commission Regulation (EU) No 605/2014 of 5 June 2014 amending, for the purposes of introducing hazard and precautionary statements in the Croatian language and its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures. Available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014R0605>

Bolt, H. M., Johanson, G., Nielsen, G. D., Papameletiou, D., Klein, C. L., 2016. *SCOEL/REC/125: Formaldehyde — Recommendation from the Scientific Committee on Occupational Exposure Limits*. European Commission, Brussels. Available at: <https://circabc.europa.eu/sd/a/2882e9bc-d52e-4944-ac08-974b43957ed2/REC-125%20Formaldehyde.pdf>