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Exposure to formaldehyde in the workplace: Wood panel manufacturing

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PREVENTION FACT SHEET

EXPOSURE TO FORMALDEHYDE IN THE WORKPLACE

WOOD PANEL MANUFACTURING

FORMALDEHYDE

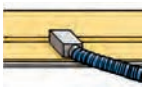
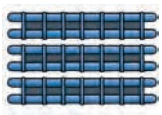
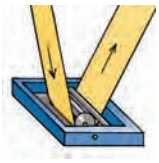
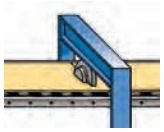
- Under normal temperature and pressure conditions, formaldehyde (chemical formula: **HCHO**) is a **colourless gas with an acrid odour** detectable at a concentration below 1 ppm (part per million in air).
- It is mostly used in the synthesis of resins containing urea, melamine or phenol. **These resins are used as adhesives** in the manufacture of wood panels, veneers, plywoods, laminates, I beams and other wood products. These resins are usually available in liquid or powder form.

EXPOSURE TO FORMALDEHYDE HEALTH RISKS AND EFFECTS

- In the workplace, formaldehyde exposure occurs in various ways. In its gaseous form, it is absorbed by the respiratory tract; when in aqueous solution, it is absorbed through skin contact. Wearing personal protective equipment reduces the risk of exposure and **health effects.**
- **The current permissible exposure value in air is 2 ppm, ceiling** –meaning a value never to be exceeded during any length of time whatsoever. Formaldehyde is a substance to which exposure must be reduced to a minimum and whose recirculation is prohibited.
- **In the case of direct skin contact, formaldehyde can cause skin lesions** such as irritation, irritant and allergic dermatitis. The symptoms are itching, tingling and redness. Skin sensitization is likely to occur after contact with aqueous solutions of formaldehyde or even with solids or resins containing free formaldehyde. When a person is sensitized, skin allergy symptoms may occur at every contact with solutions of increasingly low concentration.
- **Following exposure to contaminated air, the first effect is irritation of the eyes and respiratory tract.** The related symptoms are tingling, redness or burning of the nose and throat, nasal discharge and watery eyes. These symptoms are generally negligible to slight for exposures in the order of 0.75 to 1 ppm. They can become bothersome and even intolerable at higher concentrations mainly when they exceed 2 to 3 ppm. The appearance of effects is not related to the duration of exposure. These effects appear soon after the exposure and do not worsen with time. There does not seem to be a cumulative effect from exposure. The effects are reversible and stop shortly after the exposure stops.
- **In the case of occupational exposure over several years, formaldehyde has been related to causing cancer of the nasopharynx.** The International Agency for Research on Cancer has furthermore classified it as a human carcinogen since June 2004. In Quebec, considering the concentrations present in the workplace and the number of exposed workers, the number of cases of cancer of the nasopharynx related to this exposure remains very low. According to prudent estimates, less than one Quebec worker per year would develop cancer attributable to formaldehyde following daily exposure for 40 years.
- **Formaldehyde is measured using IRSST methods.** To evaluate a time-weighted average exposure value, formaldehyde is sampled using a tube or a passive dosimeter; analysis is done in the laboratory by chromatography. The ceiling value is measured by direct-reading instruments, but the presence of some other products can affect the results of these analyzers.

WORKPLACE EXPOSURE TO FORMALDEHYDE

WOOD PANEL MANUFACTURING

FABRICATION PROCESS	EMISSION SOURCES		CORRECTIVE MEASURES
 WOOD CHIP RESERVOIR GLUING MACHINE	• Glue preparation • Glue application • Leaks • Maintenance	< 0.3 to > 2.0 ppm	• CONFINEMENT OF PROCESS • INSTALLATION OF FUME HOODS ABOVE THE EQUIPMENT • GENERAL MECHANICAL VENTILATION
 FORMING OF MAT  BOARD PRESSING AND CUTTING	• Opening of the press (stage press) • Board outfeed (continuous press) • Stacking of boards • Quality control test • Repair and maintenance	< 0.3 to > 2.0 ppm	
 COOLER	• Collection of boards • Stacking of boards	< 0.3 to 1.2 ppm	
NON LAMINATED LAMINATION 	• Feeding of press • Impregnation tank	< 0.3 to 1.7 ppm	
 FINISHING: CUTTING AND SANDING  MATURATION STORAGE SHIPPING	• Drying of boards • Board pressing and cooling zones	< 0.3 to 1.5 ppm	• GENERAL VENTILATION • SEPARATE ROOM FROM WHERE THE BOARDS ARE PRODUCED

EMISSION SOURCES AND HAZARDOUS TASKS

- **Formaldehyde comes primarily from the resin** used in the adhesive **when it is heated.**
- Several factors affect HCHO emission, such as the **type of resin**, the pressing time, the thickness of the panel, etc. Phenol-based resins have a very low emission rate compared to urea-based and melamine-based resins. Urea-formaldehyde resin has the highest rate.
- **The most exposed workers** are those assigned to the press operating tasks (usually in the control rooms) and maintenance tasks (press operator, mechanic, electrician, cleaner, foreman, etc.) when action must be taken during a breakdown or a production shutdown. Sample collection can also expose workers to high concentrations for short periods.

MEANS OF IMPROVEMENT

- The most effective way to control workers' exposure to a chemical contaminant is **by replacing the product with a less hazardous one**. For particleboard and beams, isocyanate-based products are used in some plants. However, the toxicity of these products is high and a risk analysis is necessary. The use of a **resin with a lower formaldehyde emission rate** is one option to consider. The use of aqueous resins should be studied.
- **The installation of fume hoods** above the emission sources (press, cooler) and their **confinement** will limit the dispersion of pollutants in the work environment.
- **General ventilation** in the panel drying and storage zones will dissipate the formaldehyde that could still be released. **Confinement** of these areas will limit the dispersion and will reduce the flow necessary for general ventilation.
- For tasks during which the worker must perform short interventions when the formaldehyde concentration is high, **prevention procedures** such as wearing personal protective equipment must be well established and followed.

EMPLOYEE INFORMATION AND TRAINING ON THE RISKS ASSOCIATED WITH FORMALDEHYDE, THE EMISSION SOURCES AND MOST POLLUTING TASKS, THE MEANS OF CONTROL (INCLUDING WORK TECHNIQUES AND METHODS), AND ON PERSONAL PROTECTIVE EQUIPMENT, ARE KEY ASPECTS IN CONTROLLING EXPOSURE.

WOOD PANEL MANUFACTURING

PERSONAL PROTECTIVE EQUIPMENT

The goal of the requirements in the Quebec Act regarding occupational health and safety is to eliminate dangers at the source. When required, protective equipment must be selected according to needs:

- The type of respirator that will best **protect the respiratory tract** depends on the level of protection needed. A respirator's level of protection indicates its effectiveness. It represents the theoretical relationship between the concentration in the work environment and the concentration inside the respiratory protective equipment. A factor of 10 therefore means that the concentration inside the mask is 10 times lower than that in the work environment.
- In the case of formaldehyde concentrations below 20 ppm and up to the permissible value, **wearing a filter cartridge mask is recommended**. Depending on the required protection factor, a full mask with face shield (protection factor of 100) or a half-mask (protection factor of 10) is to be used. In the case of a half-mask, safety goggles must also be worn.
- In the case of concentrations above 20 ppm, that cause an immediate danger to life or health (IDLH), wearing a self-contained breathing apparatus or air-supply respirator is mandatory.
- For **hand protection**, nitrile, neoprene or butyl gloves offer a good resistance to formaldehyde.
- **To protect the body**, mainly when preparing powder or liquid resins, disposable coveralls are recommended.

FOR MORE INFORMATION

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