

## 6.4 Formaldehyde and Wood-Based Panels

Formaldehyde is a pungent, colourless gas composed of the elements carbon, hydrogen and oxygen. Formaldehyde is a naturally organic substance that is present all around us. Formaldehyde does not accumulate in the environment because it is broken down within a few hours by sunlight or by bacteria present in soil or water. Formaldehyde metabolises quickly so it does not accumulate in the body. For industrial use it is usually sold as a 36-50% solution in water. This solution is known as formalin. Formaldehyde has been used in the manufacture and composition of industrial products for nearly 150 years. It is a raw material in as many as 85 industries and is used for the production of hundreds of everyday products. A major use is in the manufacture of adhesive resins for woodworking industries. Formaldehyde is also used in the production of paper and textiles, cosmetics, disinfectants and medicines, and many paints, varnishes and lubricants are based on formaldehyde.

### 6.4.1 Hazards Associated with exposure to Formaldehyde

Under test conditions concentrations of formaldehyde vapour in the air is expressed in parts per million (ppm) or milligrams formaldehyde per cubic metre of air (mg/m<sup>3</sup>). For formaldehyde 1mg/m<sup>3</sup> = 0.81ppm. At levels of 1 to 3ppm it can be mildly to moderately irritating to the eyes and nose, depending on the sensitivity of the individual. At levels above 10ppm it causes immediate strong discomfort, and long term continuous exposure at these extreme concentrations would result in serious health effects. There are extreme cases known where highly allergic individuals could be affected by exposure over a wide range of chemicals even at very low concentrations.

Formaldehyde as such is classed by the International Agency for Research on Cancer as a carcinogen, basing this classification on the possible effects of large doses of formaldehyde to which workers in some chemical and manufacturing plants were formerly exposed. There is no evidence that small dosages (much lower than the guideline limit mentioned, below (6.4.2) with reference to the domestic environment) have any carcinogenic effect. A scientific conference in 2007 concluded that "the common uses of formaldehyde in consumer products and other applications does not pose a risk to human health". (FORMACARE, Barcelona 21.09.2007)

### 6.4.2 Formaldehyde Exposure in the Home

Indoor air levels of formaldehyde are not generally the subject of official regulations. However the generally accepted guideline figure for the amount of formaldehyde that should not be exceeded in ambient air from all formaldehyde emitting sources is 0.1 milligramme per cubic metre of air (equivalent to about 0.08ppm) measured over a 30 minute reference period (World Health Organisation).

The UK's Building Research Establishment has tested the air quality in typical British homes and found the average concentration of formaldehyde is less than one quarter of the guideline limit from all formaldehyde emitting sources in the home.

Not all wood-based panels contain added formaldehyde and whilst it is difficult to make any accurate projection it has been estimated that the contribution from formaldehyde from wood-based panel emissions to the ambient indoor air level would be less than one-eighth of the WHO guideline limit.

### **6.4.3 Formaldehyde exposure in the workplace**

Under the Control of Substances Hazardous to Health Regulations 2002, formaldehyde in the workplace atmosphere has a workplace exposure limit (WEL) of 2 parts per million (determined over both long term [8 hour time weighted average (TWA) reference period] and short term [15 minute reference period]).

### **6.4.4 Formaldehyde release from wood-based panels**

Not all wood-based panels contain added formaldehyde as a component of the binding system, and in those panel types where a formaldehyde based synthetic resin binder is used the amount of free formaldehyde given off by an individual panel is relatively tiny in respect to overall indoor air concentrations.

Release of free formaldehyde from wood-based panels is influenced by a number of factors including:-

Binder type, temperature, humidity, panel thickness and percentage concentration. Experiments have demonstrated that in a stable environment (temperature and humidity) formaldehyde release does decrease over time and the low initial values of typical particleboards and MDF will decrease by at least 50% within a few weeks of manufacture.

Under the provisions of the Harmonised European Standard EN 13986 "Wood-based panels for use in Construction – Characteristics, evaluation of conformity and marking" the formaldehyde release from wood-based panels used in internal applications will be classified as either Class E1 or Class E2.

The test requirements for both initial type testing and factory production control/continuous surveillance are laid down in Table 6.1 for E1 products and Table 6.2 for E2 products.

NOTE 1: Boards of Class E1 can be used without causing an indoor air concentration greater than 0.1ppm HCHO.

The test requirement does not apply to wood-based panels to which no formaldehyde containing materials were added during production or in post-production processing. These may be classified E1 without testing (see Note 2).

NOTE 2: Examples of such panel products are:

- Cement bonded particle boards (uncoated)
- Wet process fibreboard (uncoated), when no formaldehyde emitting resin has been added to the process, and
- Uncoated or coated wood-based panels glued with resins emitting either no formaldehyde or negligible amounts of formaldehyde after production as e.g. isocyanate, phenol or phenol-resorcinol glue.

The limit values for the formaldehyde class E1 are given in Table 6.1 and for class E2 are given in Table 6.2.

The EN 120 values for particleboards and MDF apply to boards conditioned to a moisture content of 6.5%. In the case of particleboards or MDF with different moisture contents, the EN 120 test result (known as the perforator value) should be multiplied by the *F* factor given in EN 312 (particleboards) or EN 622-1 (MDF) respectively. The *F* factors in these two standards are only valid for boards within the specified moisture content ranges given in the two standards.

NOTE 3: Experience has shown that to guarantee compliance with the limits in Table 6.1 the rolling average of the EN 120 values found from the internal factory control over a period of ½ year should not exceed 6,5mg HCHO/100g panel mass for particleboards and OSB or 7mg HCHO/100g panel mass for MDF.

NOTE 4: The corresponding upper requirement limits for E2-boards are found from the EN 120 or ENV 717-2 factory production/external control tests.

**Table 6.1 Formaldehyde emission class E1: classification and control requirements**

		Panel Product		
		Uncoated	Uncoated	Coated
		Particleboards OSB MDF	Plywood Solid wood panels	Particleboards OSB MDF Plywood Solid wood panels Fibre boards (wet process) Cement bonded particle-boards
Initial type testing <sup>a</sup>	Test method	ENV 717-1		
	Requirement	Release ≤ 0,13 mg/m <sup>3</sup> air		
Factory production control	Test method	EN 120	EN 717-2	
	Requirement	Content ≤ 8mg/100g oven-dry board (see Note 3)	Release ≤ 3,5 mg/m <sup>2</sup> h or ≤ 5 mg/m <sup>2</sup> h within 3 days after production	
<sup>a</sup> For established products, initial type testing may also be done on the basis of existing data with EN 120 or EN 717-2 testing, either from factory production control or from external inspection				

**Table 6.2 Formaldehyde emission class E2: classification and control requirement**

		Panel Product		
		Uncoated	Uncoated	Coated
		Particleboards OSB MDF	Plywood Solid wood panels	Particleboards OSB MDF Plywood Solid wood panels Fibre boards (wet process) Cement bonded particle-boards
Initial type testing	Either	Test method	ENV 717-1	
		Requirement	Release $\leq 0,13 \text{ mg/m}^3$ air. See Note 4	
	or	Test method	EN 120	EN 717-2
		Requirement	Content $>8\text{mg}/100\text{g}$ to $\leq 30\text{mg}/100\text{g}$ oven-dry board	Release $>3,5\text{mg}/\text{m}^2\text{h}$ to $\leq 8\text{mg}/\text{m}^2\text{h}$ or $>5 \text{ mg}/\text{m}^2 \text{ h}$ to $\leq 12\text{mg}/\text{m}^2 \text{ h}$ within 3 days after production
Factory production control	Test method	EN 120	EN 717-2	
	Requirement	Content $>8\text{mg}/100\text{g}$ to $\leq 30\text{mg}/100\text{g}$ oven-dry board See Note 3	Release $>3,5\text{mg}/\text{m}^2\text{h}$ to $\leq 8\text{mg}/\text{m}^2\text{h}$ or $>5 \text{ mg}/\text{m}^2 \text{ h}$ to $\leq 12\text{mg}/\text{m}^2 \text{ h}$ within 3 days after production	