



**EPF comments on the Commission's proposal for a delegated act on a classification system for green investments and sustainable finance**

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## **1. Executive Summary**

EPF members are extremely concerned by the Commission's proposal for a limit value for formaldehyde of 0.06 mg/m<sup>3</sup> measured according to CEN/TS 16516 (now EN 16516) or ISO 16000-3 for building components and materials used in the building renovation that may come into contact with occupiers in its proposal for a delegated act on a classification system for green investments and sustainable finance.

EPF considers that the proposal of a formaldehyde emissions limit value of 0.06 mg/m<sup>3</sup> (tested according to EN 16516), which corresponds to approx. 25% of the actual European E1 level, is entirely disproportionate for wood-based panels that are very versatile materials used in building components and materials used in the building renovation. The new EC green investment and sustainable financing proposal means a reduction of the formaldehyde emission limit by 75% compared to the actual European E1 level.

Formaldehyde is a threshold substance and the further tightening of existing regulations will not deliver any benefit of note since peak concentrations, and therefore high exposures to formaldehyde concentrations in indoor air, would remain largely uninfluenced.

Technically, to move the industry from its current standard of 0.124 mg/m<sup>3</sup> (0.1 ppm) according to EN 717-1 to 0.06 mg/m<sup>3</sup> according to CEN/TS 16516 (superseded by EN 16516:2017) or ISO 16000-3, which proposed limit can be expressed according to all experiences as 24% of this existing European E1 limit, is exponential in challenge, cost and impact. Due to the lack of viable alternatives to formaldehyde-based resins, combined with the structural properties required from the final product, the proposed limit value will realistically only be achieved at significantly higher raw material costs (essentially only PMDI as adhesive) and increased production costs (the limit is at the extremity of what can be physically tested and will lead to ca. 30% slower production speeds). In addition, this measure would lead to tremendous image damage and the complete loss of business of wood-based panels in projects under the sustainable finance regulation and similar markets. Furthermore, this limit value is very likely to spill over to other legislative and market requirements very soon leading to devastating effects.

The direct socio-economic effect of this new "green investment" proposal would be increased industry costs and job losses. The wood panel manufacturers in Europe employ a majority of skilled and semi-skilled workers and a significant number of these jobs are at risk if the EC sustainable financing proposal were to be adopted. There will also be some major indirect effects with negative consequences on the circular economy (amount of recycled waste wood will decrease if production volume of wood-based panels will be lower due to lower



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production speed) and on climate change, because consumers could turn to lower cost and less environmentally friendly alternatives that are fossil fuel based and do not have the same natural carbon storage properties as wood. We anticipate there would be an increased risk of European business leakage particularly if there is no or only limited surveillance of the high volumes of imported panels from lower cost economies such as China, South America and Turkey. We therefore propose that there is a requirement for verification and wherever possible certification that materials accepted for projects under the sustainable finance regulation comply with the relevant (actual) requirements.

Furthermore, the proposal would also jeopardise the use of recycled wood in particleboard production for use in projects under the sustainable finance regulation. Given that the particleboard industry is the only sector that is capable of recycling wood in upcycled products at an industrial scale means that this would block the currently existing and future expansion of the circular bioeconomy in the woodworking sector due to the decreasing production volumes. This would be in total contradiction to the EU's Circular Economy Action Plan and would also make it impossible to achieve the wood recycling targets at EU and national level.

Moreover, due to measurement uncertainties and the artificially high loading factors in CEN/TS EN 16516 (now EN 16516) and ISO 16000-3, manufacturers will have to use safety margins that will require them to use factory production control limits of maximum 0.025 mg/m<sup>3</sup> according to EN 717-1. At these levels the use of aminoplastic resins would become virtually impossible and the industry would be forced to switch to the use of PMDI (diisocyanates) for which additional supply possibilities actually are not available and the building of sufficient new MDI manufacturing clusters is unrealistic. In short, there would be no viable alternative to meet the required demand.

The effects of this 75% reduction from the Dossier Submitter's recommendation would be catastrophic to the wood-based panel industry, and thus to the Europe's citizens, and for no obvious gain.

**Industry costs for EC's green investment and sustainable financing limit value and alternatives**

	mg/m <sup>3</sup>	Total (M€)								
	(EN 717/1)	Annual Costs					One time Costs			TOTAL
		PB/ MDF Production Costs	PB/ MDF Lost business	Ply-wood Production Costs	Ply-wood lost business	Annual Costs Subtotal	Panel manufacturer Investments	Supplier Investments	One time costs Subtotal	Grand Total (M€)
<b>E1</b>	<b>0.124</b>	<b>79</b>	-	-	-	<b>79</b>	-	-	-	<b>79</b>
<b>E1 Plus</b>	0.08	437	-	75	-	512	-	-	-	512
<b>1/2 E1 (50% E1)</b>	0.06	1,008	348	88	125	1,568	-	1,600	1,600	3,168
<b>EC sustainable finance proposal (25% E1)</b>	<b>0.03</b>	<b>2,016</b>	<b>2,085</b>	<b>126</b>	<b>625</b>	<b>4,852</b>	<b>100</b>	<b>8,000</b>	<b>8,100</b>	<b>12,952</b>

Conclusions	mg/m <sup>3</sup>	
<b>E1</b>	0.124	€79 million is the upper estimate for the actual European E1 limit
<b>E1 Plus</b>	0.08	Alternative 1 is estimated at €512 million
<b>1/2 E1 (50% E1)</b>	0.06	Alternative 2 is estimated at €3.2 billion
<b>EC Sustainable finance proposal (25% E1)</b>	0.03	The estimated industry cost for the EC proposal is approximately €13 billion

**In our opinion, the EC's proposal is disproportionate and relative to existing indoor air levels, there is likely to be little or no reduction and therefore there would be no additional health benefit. It will no longer be technically and economically feasible for a large proportion of wood-based materials and this would favour fossil fuel-based products that would be less beneficial to health, the environment and the European manufacturing economy.**

## **2. General Comments**

The EC proposes a lower limit value of 0.06 mg/m<sup>3</sup> according to CEN/TS 16516 (now EN 16516) or ISO 16000-3, which corresponds to 25% of E1.

To lower the limits all the way down to the extremely low level of the EC's Sustainable finance proposal would be disproportionate and counterproductive even for leading actors who have worked for decades to continuously lower the formaldehyde emissions from our products.

Several of the steps needed to decrease the formaldehyde levels will be very time intensive and costly. For every step taken to reduce the emission level, the efforts needed to achieve the lower levels increase exponentially. To be safe and sustainable this needs to be a stepwise process that should not be pushed. New, not yet developed, adhesives need to be implemented in our supply chains. Time is needed to develop and test new solutions, making sure that they are available and work at an industrial scale, and that they are safe and sustainable to use.

Full harmonisation of test procedures across Europe is also very important. The reference chamber emission method for formaldehyde according to which the legal limits are defined (EN 717-1 as specified in hEN 13986 and several other standards) needs to be the same all over Europe and the test procedures must allow for efficient testing, considering both wood-based materials and articles made from these materials. EN 16516 (the current version of CEN/TS 16516) and ISO 16000-3 are test methods for determining the emissions of volatile organic compounds (VOC). Scientifically speaking, formaldehyde is not a VOC but a VVOC (very volatile organic compound). Formaldehyde can be measured with this method, but it is much less accurate and reproducible than EN 717-1. Furthermore, there exist today no correlations between EN 16516 or ISO 16000-3 and other derived test methods that are being used for the daily factory production control. Additionally, the test result according to EN 16516 and ISO 16000-3 delivers roughly the double result as when testing by EN 717-1, due to the double loading factor specified on the basis of the European reference room for VOC and the reduced air exchange rate (reduction by 50%). Recent scientific evidence by Prof Salthammer has found that the reference room "greatly overestimates the formaldehyde concentrations in indoor areas" (see [Formaldehyde sources, formaldehyde concentrations and air exchange rates in European housings - ScienceDirect](#)).

Today there is not the industrial capacity to produce alternative adhesives free from formaldehyde emission available at the scale required to meet the expected additional demand for wood-based panels for renovation and sustainable finance projects under the European Green Deal and the Recovery Package. PMDI is the only industrially proven formaldehyde free adhesive for wood-based panels, but it can only support approximately 20-25% of the annual particleboard and MDF production. Through the development of combined adhesive systems such as combinations of aminoplastics + PMDI, this percentage could be increased, although it is expected that the maximum would be 50%.

Additionally, all alternatives must prove that they are also acceptable from a chemical and occupational health point of view. In addition, changing to PMDI requires changes to equipment and practices. The capital costs alone could run to several hundred thousand euros per site. We need additional time, together with our partners, to perform the development work needed to find new innovative and safe solutions. The necessary quick and tremendous increase in PMDI production is not possible from standpoint of necessary investment volumes, which is estimated at € 8.1 billion for the particleboard and MDF industry; additionally, it has to be expected that any new capacity will be installed outside Europe due to environmental reasons, causing loss of industrial production in Europe and high transport costs.

To go for harmonisation Europe-wide is crucial to success; to remove barriers for trade, create a level playfield, and, more importantly, strengthen the protection of European citizens.

### **3. Technical limitations**

The proposed limit value of 0.06 mg/m<sup>3</sup> according to CEN/TS 16516 (now EN 16516) or ISO 16000-3 is unachievable with formaldehyde-based resins for some wood-based panel types. With lower formaldehyde limits the board and processing properties are negatively influenced. The board properties become worse. This is particularly noticeable in the case of moisture resistance (thickness swelling and long-term behaviour under strongly humid conditions) and strength properties (long-term loads must also be taken into account here).

Wood-based materials have functions to fulfil and therefore require a certain minimum of strength and stability. These minimum requirements can no longer be met with formaldehyde-containing resins, if formaldehyde emissions are set too low. This mainly applies to boards for the construction sector (according to EN 13986). These load-bearing boards need special bonding solutions to achieve low formaldehyde emission, such as using PMDI as sole adhesive or as co-reactant with substantial proportion in the adhesive system.

Certain **fibreboards** (thin MDF, HDF boards with low swelling as core boards for flooring) can only be made with a melamine reinforced UF adhesive. Alternative is the use of PMDI, causing severe production problems and as well as much higher costs. These boards are used especially for flooring applications and various other applications in furniture production, such as back panels. It is not clear which adhesive can be used in industrial scale for this product group, if melamine reinforced UF adhesive will be unable to be further used due to the restriction in formaldehyde emission.

#### **Plywood**

We estimate that in the **plywood** sector up to 50% of the products could not be able to achieve the proposed limit, especially in the building sector where strength requirements won't be reached with such a low formaldehyde limit, especially because the only non-formaldehyde adhesive PMDI (a diisocyanate) cannot technically be used in plywood manufacture. Also the technical requirements regarding humidity (EN 636-2) won't be met; this is even more the fact with EN 636-3. We assume that plywood panels in applications with structures that are thicker than 40 mm will have to leave the market. That affects building products as well as all other applications – and even if the products are encased like in the area of furniture or sports equipment, where the structural properties / strength requirements are also crucial.

The characteristics of the poplar plywood are lightness and specific technical performance (e.g. bending, modulus of elasticity, extraction of the screw, decorative purpose etc.) that guarantee an excellent workability of the panel (milling, cutting, lower tool consumption and finishing etc.). These characteristics are obtained mainly from the use of poplar wood, from the layer composition from veneers of different thickness, and from the use of a resin that respects the elasticity of the wood (UF or MUF).

The **emission level** in the EC proposal, in addition to unjustifiably increasing production and quality control costs, would eliminate the use of poplar plywood in various application areas in favour of panels produced outside the EU or even to the advantage of other materials such as plastics.

#### Industrial use

Most wood-based panels are not used in a raw form, but instead have some type of surface finish over the substrate that generally acts as a barrier to off-gassing, thereby reducing emissions. On top of several academic studies that demonstrate a barrier effect of coatings in formaldehyde emission, the experience in the industry in surfacing particleboards and MDF with melamine resin impregnated papers prove that emission is reduced drastically: expected reduction around 80 – 90% in literature, values from industry confirm an average reduction 83 – 85%.

The wood-based panel industry in Europe is therefore confronted with a non-uniform actual market situation. On the one hand, it is common consensus that E1 (0.1 ppm according to EN 717-1) is safe from health standpoint.

On the other hand, partly national regulations, consumer requests, or voluntary quality labels or producer-based quality label have created various lower levels of limits of the subsequent formaldehyde emission and introduced in the market. Based on the experience in industry a limit in the range of 0.05 ppm based on EN 717-1 for raw boards is the outmost which still can be achieved but with relevant additional costs amounting to some €3 billion.

Further reduction in the emission limit as according to the EC proposal could be feasible for some products, but suffer from long term and secured industrial experience and from guaranteed availability of raw materials, such as melamine or PMDI for full transition of the whole European board production such as particleboard and MDF/HDF; additionally this would lead to costs amounting to some €13 billion and causing more than half a million job losses.

Also, wood-based panels contribute to mitigating climate change through forming a storage pool of carbon; they can be used to replace materials with less positive environmental impact (fossil based or high energy demanding products).

Properties such as dimensional stability, swelling and durability are affected by the use of amino resins with very low molar ratios and / or increasing dosage of formaldehyde catchers.

A severe restriction in formaldehyde emission could lead to a lack of guarantee of required product physical and mechanical properties and process safety margins.

Adoption of PMDI as adhesive will be difficult to justify due to impact in production costs leading to a lack of competitiveness of wood-based panels.

#### **4. Resins & lack of available solutions**

An evaluation of possible substitutes for formaldehyde-based resins and the issues related to them can be summarized briefly as follows:

- Availability issues with PMDI

The market for PMDI is tight. It mainly depends on the overall economic situation; main product for isocyanates are foams for various applications, such as in automotive or in construction and insulating. The increasing demand due to future increased activity of insulation in construction will lead to higher demand on isocyanates. This will even restrict more the capability for serving the wood-based panels industry. PMDI prices show a broad range and fluctuation, which both lead to uncertainties for producers and customers.

- Availability issues with melamine

The wood-based panels industry is already now important target for use of melamine. The expected increase in melamine demand if aminoplastic resins must be adapted to fulfil the EC sustainable financing proposal will need additional production capacities, which foreseeable will not be installed in Europe due to raw material and energy costs.

- Cost issues with substitutes

Whatever alternative to existing and established UF resins will be used (if technical industrial performance is given at all), increased costs by up to 30% based on actual costs by the adhesive can be expected if the EC proposal becomes mandatory.

- Capacity losses with substitutes

It is well known that the capacity will drop, if alternative adhesives will be used. The capacity loss must be estimated with approx. 20% when the EC proposal would be executed.

- Other availability issues

The biggest problem is that also all alternative adhesives (beside PMDI), such as adhesives based on natural resources, only show questionable performance and are not able to fulfil the material demand of the wood-based industry. Furthermore, PMDI is not applicable in plywood manufacture.

## 5. Emission tests and reproducibility

The EN 717-1 chamber test was developed to determine accurately the formaldehyde emission from wood-based panels. The test method is optimised for the determination of the steady state concentration within narrow tolerances of temperature and air humidity.

A specific but manageable analytic procedure based on photometric or fluorimetric procedure and consecutive determination of chamber concentration allows the determination of the steady state concentration within a test duration of usually not more than ten to fifteen days. The comparably short test duration is a great advantage for practical application and helps to save time and costs.

The determination of the steady state concentration is an efficient tool to evaluate formaldehyde emissions of all concerned materials and construction products. It is a reproducible value, exactly to determine and in a shorter time than by procedures defined for other chamber test procedures.

EN 717-1 is anchored in our European standards (EN 300, EN 312 and EN 622-1 respectively as well as in EN 13986).

## 6. Costs of investments and issues

### Particleboards

- E2 → E1                                   + 10 %
- E1 → E1Plus                            + 5 – 8 %
- E1 → E1/2                               + 15 %
- E1 → 25 % E1                         actually not clearly and correctly predictable; this depends on the relevant technical solutions if available at all (technical solution includes secured availability, which in the case of PMDI is not only not secured but clearly not existing); it also includes impact on capacity of the production lines due to only restricted information for such productions. The reason for the unpredictability is also given from the fact that no wide experience exists with such productions, except of a certain European production of PMDI bonded wood-based panels (which are mainly OSB and only special products when talking about particleboard and MDF) and a restricted volume of so-called F\*\*\*\* boards for the Far East market (but based on fully different quality and test method standards, especially concerning formaldehyde emission).

The cost increase for **MDF boards** is even slightly higher.

For the **plywood** industry the situation is different: The step from E1 to E1 Plus would increase the cost by 75 M€, the step from E1 to E1/2 would increase by 88 M€ with an added loss in business of 125 M€ and the step to 25% E1 would increase the costs at European level at least by 125 M€ with a loss in business of 625 M€ and result in approximately 12,300 job losses.

It is obvious that there is no linearity between lowering the formaldehyde emission and the increase of costs. As the figures show there is a strong non-linearity and therefore there is a huge step regarding costs between E1/2 and 40% E1. There is a kind of edge at E1/2 at least for particleboard and MDF industry.

- Additional investments needed to use substitutes (e.g. total enclosure for PMDI)

For the production of boards with PMDI an additional gluing line is needed (tank, pipes, spraying device etc.). In addition, a device for the application of release agent on the press belts is needed.

Costs related to use of PMDI on particleboard production plant:

- PMDI unloading from truck: a completely new system for PMDI unloading from trucks must be implemented. This system requires heated tanks, recirculation pumps, closed loop for air intake into the

tank, moisture trap or usage of nitrogen to avoid contact between PMDI and air moisture. Estimated costs are 150 k€ per line.

- PMDI dosing system: a new dosing system must be implemented for PMDI handling (pumps, buffer, flow sensors, HW+SW control, pipes etc.). Estimated costs are 50-100 k€ per line.
- Release agent: the use of PMDI in surface layer requires the utilisation of release agents to prevent sticking of glued particles to press belts. Release agents can be pre-dosed in the blender or sprayed onto the steel belt. In both cases a new dosing system is required (estimated costs of 50-150 k€ per line). Application of release agent onto the steel belt can be critical due to uneven distribution over the steel belt width and the risk of dropping onto the mat. Addition of release agents has a significant impact on cost of production (3 – 5 €/m<sup>3</sup>).
- There is little experience on the use of PMDI for particleboards and MDF, most of the applications are in OSB production. Usually OSB board are not coated, overlaid or veneered. The use of release agents during pressing could create big problems for coating, overlaying, and veneering processes on MDF and particleboard due to residual traces of releasing agent on the board surface despite sanding, that will prevent good and complete adhesion of overlays, coatings and veneers, without unadhered spots.
- Increased maintenance and downtime: PMDI quickly reacts with water, contained in additives used in particleboard production and as air moisture. This implies that wood particles tend more frequently to stick to machines' walls and pipes. Consequently, production downtime and maintenance effort significantly increase and productivity rate is affected negatively, causing extra direct costs as well as increase in indirect costs.
- Press steel belts: press steel belts represent one of the most expensive parts on the production line (600-1,000 k€ per line). Usual lifetime of steel belts with UF resins is estimated around 10 years. Extended use of PMDI on surface layer significantly affect this duration, reduced to 4-6 years.
- Workers' health: PMDI reacts quickly with air humidity and with water contained in additives (release agents, etc.). Reported health hazards with PMDI upon contact are skin irritation, serious eye irritation, respiratory irritation, suspected carcinogenicity, and suspected damage to organs through prolonged or repeated exposures. Workers need therefore more severe precautionary measures than for UF resins. Increased air outtake has to be implemented to reduce PMDI vapours and aerosol concentration in working ambient. Cleaning can be really critical since water cannot be used. Manual efforts are significantly increased.

Cost impact: full PMDI production of particleboard is expected to generate an additional cost for chemicals of +30 euro/m<sup>3</sup> (calculated at the actual price of the different needed products), plus the cost of investments and additional costs for increased downtime and maintenance effort. In this contemplation it is not yet considered, that PMDI will not be available at all in the needed volumes. For multi-daylight presses that are still mostly used in smaller and medium-sized companies, the addition cost is estimated to be higher in the order of +40 euro/m<sup>3</sup> which could in some cases lead to the non-viability of the factory.

**Construction panels** for structural use are especially affected by the EC' proposal. Boards of these types, intended for use in construction, fall under the scope of the harmonised standard EN 13986 Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking and must therefore carry a CE mark. Since July 2013, CE marking has been mandatory in all EU countries under the Construction Product Regulation (CPR). This imposes greater obligations on the whole supply chain to ensure that materials comply with the applicable standards and relevant technical information is passed to all that need it.

Unlike previous standards, which were largely prescriptive and based on manufacturing requirements, EN13986 specifies product performance supported by other standards defining test methods, quality control procedures, and guidance on use. The product characteristics must be evaluated and included in the manufacturer's Declaration of performance (DOP) that should be prepared before placing the product on the market. On top structural panels are subjected to assessment and verification of constancy of performance (AVCP), meaning manufacture has its factory production control system certified by a European Notified Body.

As it is clearly understood from the description above, the process to produce and put in the market structural panels for construction has a regulated framework that leads to a demanding, time consuming and expensive process. The introduction of a new formaldehyde emission class would require the development of new formulations, and therefore will lead to retesting and recertification of the whole range of products with major impact on product availability and to strong economic effort for producers.

Furthermore, huge additional costs will need to be made in the case of implementing the new EC sustainable financing proposal for **construction panels** for structural use (system 1, 2+, table ZA.2, EN 13986), **fire retardant panels** and **acoustic panels** made with fire retardant non-structural panels (system1, table ZA.2, EN 13986).

Similar additional testing and certification will be required for construction panels for structural use as well as for acoustic panels. This will lead to millions of euros of additional costs and it will take years to complete all testing and certification.

### Industry costs for EC's green investment and sustainable financing limit value and alternatives

	mg/m <sup>3</sup> (EN 717-1)	Total (M€)								
		Annual Costs					One time Costs			TOTAL
		PB/M DF Production Costs	PB/M DF Lost business	Ply-wood Production Costs	Ply-wood lost business	Annual Costs Subtotal	Panel manufacturer Investments	Supplier Investments	One time costs Subtotal	Grand Total (M€)
<b>E1</b>	<b>0.124</b>	<b>79</b>	-	-	-	<b>79</b>	-	-	-	<b>79</b>
<b>E1 Plus</b>	0.08	437	-	75	-	512	-	-	-	512
<b>1/2 E1 (50% E1)</b>	0.06	1,008	348	88	125	1,568	-	1,600	1,600	3,168
<b>EC sustainable financing proposal (25% E1)</b>	<b>0.03</b>	<b>2,016</b>	<b>2,085</b>	<b>126</b>	<b>625</b>	<b>4,852</b>	<b>100</b>	<b>8,000</b>	<b>8,100</b>	<b>12,952</b>

PB/MDF Assumptions	mg/m <sup>3</sup>	
E1	0.124	No extra cost, no PMDI needed
E1 Plus	0.08	Based on 6.5% extra cost v E1
1/2 E1 (50% E1)	0.06	Based on 15% extra cost v E1, 5% of business is lost (speed and non-panel competition), 8% of resin converts to PMDI
EC sustainable finance proposal (25% E1)	0.03	Based on 30% extra cost v E1, 30% of business lost (speed and non-panel competition) 40% of resin converts to PMDI

Plywood Assumptions	mg/m <sup>3</sup>	
E1	0.124	No extra cost
E1 Plus	0.08	30 MEUR extra cost calculated for Spain, and Italy, and 15k for rest of EU
1/2 E1 (50% E1)	0.06	Further increase in costs around EU. Also plywood class 3 for decorative applications lost.
EC sustainable finance proposal	0.03	Further increase in costs, now including birch plywood testing. All southern plywood packaging industry lost





(25% E1)		
<b>Conclusions</b>	mg/m <sup>3</sup>	
<b>E1</b>	0.124	€79 million is the upper estimate of the Dossier Submitter's Proposal
<b>E1 Plus</b>	0.08	Alternative 1 is estimated at €512 million
<b>1/2 E1 (50% E1)</b>	0.06	Alternative 2 is estimated at €3.2 billion
<b>EC Sustainable finance proposal (25% E1)</b>	0.03	The estimated industry cost for the EC proposal is approximately €13 billion

## 7. Socio-economic impacts & jobs losses + supply chain issues

### 7.1 Job Losses

It is expected that the EC proposal of 25% E1 could close down approximately 70% of our industry. An evaluation of the ensuing job losses in September 2019 arrived at a total of 1.2 million jobs at risk.

The following examples for Spain and Italy demonstrate the expected devastating consequences including complete closures of certain businesses, especially poplar plywood:

- 15-20% of the Spanish industrial plywood industry and 100% of the plants manufacturing plywood for fruits and vegetables packaging will be closed leading to 8000 to 11,000 job losses;
- In Italy 80% of plywood production is made of poplar wood. The unjustified increase in costs generated by the emission limitation due to the EC sustainable financing proposal will put Italian poplar plywood for fruit and vegetable packaging out of the market (favouring other materials – e.g. plastic) and panels for outdoor use and / or in a protected humid environment.

Overall, it is reasonable to assume that the 25% E1 level proposed by the European Commission could lead to a loss of 30% of the industry business, due to technical and cost reasons. Using this figure of 30% rather than 70% across the same set of data would give a table as below. **This is a loss of more than half a million jobs.**

#### Expected job losses from 0.06 mg/m<sup>3</sup> EC green investment and sustainable financing restriction

Industry	Jobs	% loss	Jobs lost
Panels	100,000	30%	30,000
Panels indirect job losses (interim, contractors)			85,714
Construction (wood-based)	870,000	18%	155,357
Furniture	1,020,000	17%	170,486
Chemicals (aminoplast resins)	30,000	36%	10,671
Services	230,000	27%	62,100
<b>Total</b>	<b>2,250,000</b>	<b>23%</b>	<b>514,329</b>

The table above shows the 514,000 jobs that, as we calculate, would be likely to disappear at the emission level (0.06 mg/m<sup>3</sup>) as proposed by the EC sustainable financing proposal; this calculation is based on the estimation that maximum 50% of the PB/MDF production could switch to PMDI due to lack of PMDI availability. However, this is probably an underestimation. If the PMDI industry did not invest in the new capacity that we calculate would be needed if the EC's proposal were to be adopted, or if construction of these plants were rejected in Europe by the authorities as is highly likely, then we calculate that 50% of industry jobs, or 857,000 positions would be lost at the emission level of the EC sustainable financing proposal.

## 7.2 Negative Climate Effects from 20% loss of the industry

Climate change is one of the main environmental challenges that we face and anthropogenic greenhouse gas (GHG) emissions are the primary cause. Atmospheric carbon dioxide (CO<sub>2</sub>) is one of the most important GHGs both for its role in heating Earth and for the impact that humans have on its concentration (Hansen et al. 1981, Anderson et al. 2016). To mitigate this impact the role of the forest in terms of carbon sequestration is well-known, but only recently the carbon mitigation value of wood-based products in buildings and furniture has been enhanced. The European Union has demonstrated leadership in fighting climate change, promoting the energy transition and creating new opportunities for European citizens through the circular economy.

The EU policies for a competitive economy with low carbon emissions boost the use of wood products and wood structural elements in the building industry. Every cubic metre of wood used as a substitute of carbon-intensive materials (such as steel or concrete) reduces emissions by up to 2.5 t CO<sub>2</sub> equivalent. If we lose 20% of the industry, then this is 20% of 57.6 million m<sup>3</sup>. **This missed substitution opportunity corresponds to approximately 30 million tonnes of emissions, or the equivalent of more than 6 million passenger vehicles driven for one year.**

## 7.3 Negative Circular Economy impact by loss of recycled wood in particleboard

The European Commission has adopted a new [Circular Economy Action Plan](#) including initiatives along the entire life cycle of products, targeting promoting circular economy processes, fostering sustainable consumption, and aiming to ensure that the resources used are kept in the EU economy for as long as possible. The wood-based panel industry is aligned with these goals by promoting the use of recycled wood and so making an efficient and rational use of natural resources. The use of recycled wood in the production of wood-based panels is best practice and an important step in circular economy. The use of recycled wood totally fulfils the circular economy requirements and the best Life Cycle Assessment (LCA) results. The conformity to the Best Available Technologies grants safety of the articles manufactured. The constant improvement of recycled wood utilisation allows evident advantages on both, environmental and economic impact.

The investments done and the technologies developed so far in the particleboard production meet the E1 emission class (Fd < 0.124 mg/m<sup>3</sup> according to EN 717-1). The emission requirements in E1plus and ½E1 classes (respectively Fd < 0.08 and 0.062 mg/m<sup>3</sup>, both according to EN 717-1) are also guaranteed with the use of recycled wood, despite some losses in productivity and significant full/total cost increasing.

**A potential eventual further reduction of formaldehyde emission (as in the case of the EC proposal) will lead to a substantial loss of production volumes of wood-based panels (30%) and with this to a reduction of the amount of recycled wood used due to the smaller production volume.**

## 8. Health benefits

### Limited effect on indoor air quality

With indoor concentrations, as with other exposure estimates, there is usually no question of whether a worst-case situation occurs or not. Rather, it has to be assessed with what probability such an exposure situation occurs. With regard to exposure to formaldehyde in European households, the essential percentiles (50-P, 95-P and 99-P) are significantly below the current World Health Organization (WHO) guideline value of 0.1 mg/m<sup>3</sup> (source: Fraunhofer WKI report MAIC-2017-3750). The resulting log-normal distribution gives a 50-P (P = percentile) of 23.1 µg/m<sup>3</sup> and a 95-P of 59.4 µg/m<sup>3</sup>. In a German Environmental Survey of 2017 (GerES V) with 639 participants a 50-P value of 24.9 µg/m<sup>3</sup> and a 95-P value of 55.1 µg/m<sup>3</sup> were measured. A recent survey of volatile organic compounds (VOC) in 169 energy-efficient dwellings in Switzerland shows that the median concentration of formaldehyde in the dwellings was 14 µg/m<sup>3</sup> with a maximum of 50 µg/m<sup>3</sup> (Yan et al. 2020). Dwellings with the highest concentration of formaldehyde and VOC's had a direct passage towards the garage or were not properly ventilated.

This means that only in very rare cases this threshold cannot be respected. According to Salthammer (Monte-Carlo simulations of formaldehyde concentration scenarios in the European reference Room under special

consideration of reduced formaldehyde emission rates of wood-based products and furniture and comparison with temporary formaldehyde sources. Fraunhofer WKI, 2019), potential problems of high formaldehyde exposure are mainly due to temporary sources, whose release potential for formaldehyde is not subject to any regulations. The proposed further tightening of already existing regulations would have no effect on the indoor air situation. This aspect is of particular importance in the case of formaldehyde, as it is a substance with a threshold effect.

Several studies on formaldehyde concentrations in US housings show a practically identical concentration distribution as in Europe (Dodson et al. 2017; Doll et al. 2016; Less et al. 2015; Liu et al. 2006; Mullen et al. 2016; Pigg et al. 2018). This is remarkable, because CARB defines very restrictive requirements for the release of formaldehyde from wood-based materials in the United States for more than 10 years. This is a nice example showing that lowering the thresholds for wood-based panels or construction products has no effect on the indoor air concentration.

It would in no way be proportionate to restrict articles in their formaldehyde emission that are not the cause of isolated peaks.

The formaldehyde concentrations in European households are well below the WHO guideline value of 0.1 mg/m<sup>3</sup>. It is not expected that further restrictions on the release of formaldehyde from construction products can significantly lower the average concentrations. An argument of low air exchange rates is not a sensible criterion for justifying logistically complex and costly emission-reducing measures to protect against health-threatening exposures. If there are insufficient air exchanges, carbon dioxide prefers to accumulate in the room air. For this reason alone, adequate ventilation must be ensured, which can usually be achieved with simple means.

The EC's sustainable financing proposal is also questionable from an economic point of view, since little effect would be achieved with disproportionate effort. Manufacturers would have to create new correlations between the test chamber and derived methods for many products at great expense. In addition, it should be noted that construction products, in particular wood-based materials, must also meet minimum mechanical requirements. Therefore, changed recipes also require new mechanical tests.

In summary, it can be said that the emission reduction of construction products proposed by the EC to 0.06 mg/m<sup>3</sup> according to CEN/TS 16516 or ISO 16000-3 (estimated approximately 0.03 mg/m<sup>3</sup> according to EN 717-1) for the purpose of sustainable reduction of formaldehyde concentrations in the interior toxicological and economic perspective is hardly justifiable. In this regard, reference should again be made to the final statement in the MAIC-2017-3750 report:

*“In view of the discussed aspects, as well as taking into account outdoor air conditions and diverse secondary sources, the potential problem of exposure to high formaldehyde concentrations in indoor areas can therefore not be solved through the further tightening of already existing regulations, in particular because peak concentrations and therefore high exposures would remain largely uninfluenced. This aspect is of particular importance in the case of formaldehyde, as it is a substance with a threshold effect.”*

## **9. Conclusions**

The current limit of 0.124 mg/m<sup>3</sup> under the conditions prescribed in the European Standard EN 717-1 corresponds to emission class E1. E1 is classified as harmless to health. All EPF member companies adopted a voluntary industry agreement to produce only panels complying with the formaldehyde emission class E1. Only imported panels from outside the EU often show (substantially) higher emissions.

The EC proposes 0.06 mg/m<sup>3</sup> according to CEN/TS 16516 (now EN 16516) or ISO 16000-3, corresponding to 0.03 mg/m<sup>3</sup> according to the conditions prescribed in the European Standard EN 717-1 (i.e. 75% below E1). This is for several wood-based panels technically not feasible as explained in this paper, especially not if the panels still need to meet the specification requirements of the user such as mechanical properties and moisture resistance. For the products where it could be technically feasible, the costs would be prohibitive and there would be insurmountable availability issues leading to huge capacity and market losses and consequently job losses.

Experience shows that the technically feasible limit is the so-called “E1-half”, corresponding to 0.05 ppm or 0.062 mg/m<sup>3</sup> according to EN 717-1 for boards as put to the market. This could be seen as landing zone for any compromise and it even would provide harmonisation in Europe, based on existing market situation. It could also be sensible to specify such a lower level taking into account the ambitions of sustainability under the European Green Deal. However, this level is the utmost decrease in emission which can be achieved with relevant additional and just still acceptable efforts and costs, and already leads to additional costs in production of some €3 billion. This is due to higher material costs for the adhesive as well as slower operation and loss of capacity. On the other hand, the effect of the EC’s proposal will be that many wood-based materials will no longer be able to achieve with proportional effort, as this could lead to additional costs of nearly €13 billion; additionally, more than half a million job losses are forecast. The relationship between emission and feasibility is exponential and not linear. If the EC sustainable financing proposal were to be implemented, Europe’s citizens would pay a heavy price for no clear gain.

Today there are no alternative adhesives free from formaldehyde emission available in sufficient volumes in the actual needed amounts, that are also acceptable from a chemical/technological and occupational health point of view and available in the needed amounts to fulfil the raw material needs of the actual and strong European wood-based panels industry. PMDI would be a technically feasible alternative in most cases, but e.g. not suitable for use in plywood manufacture. The main problems with PMDI are health and safety related as well as the far too low availability at the market (this bottleneck will not be removed even within the next one or two decades). Novel adhesives based on natural resources (such as proteins, carbohydrates, or lignins), which are also free of formaldehyde and formaldehyde emission, unfortunately are not yet available for industrial use due to insufficient performance, despite huge effort in R&D; additionally, also for these adhesives based on natural resources the question of sufficient availability is far from any idea of a solution.

Furthermore, wood-based panels offer great opportunities for meeting the ambitions of the European Green Deal and the EU Recovery package, since they are made from wood as naturally renewable raw material. They are very versatile with a broad range of applications in construction, renovation and decoration, as well as in furniture and other applications. Furthermore, wood-based panels have excellent environmental credentials, since they store biogenic carbon; they require much less (fossil) energy input during manufacture than alternative materials such as steel, aluminium, concrete, bricks, or plastics. Wood-based panel manufacturers are applying the cascading use of wood principle as much as possible to extend the lifetime of the carbon bound in the wood. Moreover, the particleboard industry is the only sector that can recycle wood on an industrial and sustainable scale thanks to the availability of a wide variety of technologies for sorting and cleaning wood residues and wastes.

**The EC’s proposal is disproportionate, does not bring any health benefits, is no longer technically and economically feasible for a large proportion of wood-based materials, and would favour products that would be less beneficial to health and the environment.**

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*EPF represents the manufacturers of wood-based panels being particleboard, dry process fibreboard (MDF), oriented strand board (OSB), hardboard, softboard and plywood. EPF has members in 32 European countries. The EU wood panel industry has a turnover of about 22 billion euro every year, creates over 100,000 jobs directly and counts more than 5,000 enterprises in Europe. The production of wood-based panels in the EU-28 (+EFTA) in 2019 was an estimated 59.2 million m<sup>3</sup>. [www.europanel.org](http://www.europanel.org)*

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