



## General Information

Formaldehyde is a naturally occurring organic compound made up of carbon, hydrogen, and oxygen. It is commonly used as an ingredient in complex compound products in the automotive, textile, construction, pharmaceutical, and cosmetic industries.

Wood adhesives are commonly manufactured with formaldehyde and generally categorized as phenol-formaldehyde, resorcinol-formaldehyde, phenol-resorcinol-formaldehyde, melamine-formaldehyde, or a urea-formaldehyde type adhesive. Concerns regarding formaldehyde emissions in the past have been mainly in regard to urea-formaldehyde adhesives. Urea-formaldehyde has been used in non-structural composite wood products: particleboard, medium design fiberboard (MDF), and hardwood plywood. Urea-formaldehyde foam insulation was used in residential construction in the 1970's and early 1980's until concerns regarding emissions led to the discontinuation of use.

Engineered wood product standards require that all structural adhesives comply with ASTM D2559: Standard Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions. Urea-formaldehyde is not water-resistant and thus does not meet this standard. Phenol-formaldehyde, melamine-formaldehyde and phenol-resorcinol-formaldehyde adhesives meet the performance requirements of ASTM D2559 and thus are used extensively in engineered wood products. Phenol-formaldehyde adhesives are used in the bonding of wood veneer, while melamines are currently used as the fingerjoint adhesive in BOISE GLULAM® beams. Boise Cascade also utilizes isocyanate adhesives, which do not contain formaldehyde, in certain bond surfaces of its products.

Phenol formaldehyde (PF) was developed in the 1930's and has been used in the plywood industry ever since. PF is a synthetic adhesive which, when its two components are combined, produces a thermosetting polymer with properties completely distinct from the phenol or formaldehyde. The formaldehyde is transformed to stable methylene linkages, which do not break down over time and/or exposure to moisture. Extensive emission testing has been conducted on PF adhesives within wood products (ref. 1). Per the U.S. Environmental Protection Agency: "Pressed woods that contain PF resin generally emit formaldehyde at considerably lower rates than those containing UF resin." (ref. 2).

## Formaldehyde Emission Standards

The State of California's Air Resources Board (CARB) has issued an order titled Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products (sections 93120 – 93120.12, title 17, California Code of Regulations). Within this order, "composite wood products" are defined as hardwood plywood, particleboard, and medium density fiberboard. It is specifically noted that structural wood products, such as OSB, plywood, wood I-joists, LVL, and glulam are not included within the "composite wood products" term in this standard.

Even though the CARB Formaldehyde Emissions Standards do not apply to Boise Cascade's EWP products, emission testing was conducted due to the confusion surrounding the term "composite wood products" and in order to demonstrate that our products have very low formaldehyde emissions. The testing confirmed that emissions were lower than those required for Phase II (less than 0.05 ppm) compliance for hardwood plywood under the CARB standard (TECO Project Report 08-0092, May 2008).

Further testing was conducted by the APA-The Engineered Wood Association to list Boise Cascade EWP products in the following APA Low Formaldehyde Emissions Product Reports ([www.apawood.org/product-reports](http://www.apawood.org/product-reports)):

BCI®/ AJS® Joists: APA PR-E730

Versa-Lam® LVL: APA PR-E720

BOISE GLULAM®: APA PR-E740

In 2010, the Toxic Substances Control Act (TSCA) was amended to add Title VI -the Formaldehyde Standards for Composite Wood Products Act. This act mirrors the CARB standard and took effect on June 1, 2018. Similar to the California order, composite wood products regulated by this federal law do not include structural wood products. Phenol-formaldehyde is exempted as an “ultra-low formaldehyde emitting resin” within this law.

### Green Building Codes, Standards and Rating Systems

Most green building code, standards, and rating systems provide credits or points for the use of products that do not contain urea-formaldehyde adhesives. Since Boise Cascade Engineered Wood Products do not contain urea-formaldehyde adhesives, their use qualifies for these credits. The following is a list of pertinent green building credits regarding formaldehyde emissions:

- National Green Building Standard (ICC 700 2020, 2015, 2012 and 2008)
  - 901.4(6) Non-Emitting Products
- LEED®: U.S. Green Building Council
  - LEED v4.1, v4: Single Family, BD&C, ID&C: EQ Low Emitting Materials
  - LEED 2009: EQ 4.4 Low-Emitting Materials
- 2022 California Green Building Standards Code (CALGreen)
  - 4.504.5, 5.504.4.5: Composite wood products emissions
- International Green Construction Code™ (IgCC): International Code Council (2015, 2012)
  - 806.1: Formaldehyde Emissions

Further information on green building codes, standards, and rating systems may be found in Boise Cascade’s ICC-ES VAR Environmental Report, VAR-1017 ([http://www.icc-es.org/reports/pdf\\_files/VAR-1017.pdf](http://www.icc-es.org/reports/pdf_files/VAR-1017.pdf)). This report provides the design professional a reference for all potential green building credits that Boise Cascade EWP products may be eligible for.

### References

Emery, John A. 2002. Structural Wood Panels and Formaldehyde. APA The Engineered Wood Association. Tacoma, WA.

U.S. Environmental Protection Agency. An Introduction to Indoor Air Quality. <https://www.epa.gov/formaldehyde>. U.S. EPA, Washington, DC.