**HT 3: RESTRICT CANCER-CAUSING FORMALDEHYDE IN BUILDING MATERIALS**

New York City Health Code; New York City Building Code; New York City Administrative Code
Proposal developed by the Materials & VOCs Committee

## Summary

**Issue:**
Formaldehyde is a carcinogen and irritant found in composite wood materials, which are widely used in construction.

**Recommendation:**
Limit the content of formaldehyde in non-structural composite wood products.

## Proposed Legislation, Rule or Study

**Amendments to the New York City Health Code:**

1. Add a new section 131.14 as follows:

   §131.14 Formaldehyde. (a) This section shall apply to any hardwood plywood, particleboard or medium density fiberboard, or pre-manufactured product containing such materials, installed in a building; provided, however, that this section shall not apply to any building classified in occupancy group R-3 under the New York City Building Code until July first, two thousand sixteen and shall not apply to manufactured homes.

   (b) Any material or product covered by this section shall comply with the following standards as of the dates set forth therein and as tested by a third-party certification organization using the protocols of ASTM E 1333-96:

<table>
<thead>
<tr>
<th>Material Type</th>
<th>As of July 1, 2010</th>
<th>As of July 1, 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardwood Plywood Veneer Core</td>
<td>0.05</td>
<td>--</td>
</tr>
<tr>
<td>Hardwood Plywood Composite Core</td>
<td>0.08</td>
<td>0.05</td>
</tr>
<tr>
<td>Particleboard</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Medium Density Fiberboard</td>
<td>0.21</td>
<td>0.11</td>
</tr>
<tr>
<td>Thin Medium Density Fiberboard (max. thickness 8 mm.)</td>
<td>0.21</td>
<td>0.13</td>
</tr>
</tbody>
</table>

   (c) By July first, two thousand sixteen, and at least every 3 years thereafter, the department shall review and, if necessary, update or revise the standards in this section.
Amendments to the New York City Building Code:

1. Add a new Section 2303.8 as follows:

   2303.8 Formaldehyde limits. Any hardwood plywood, particleboard or medium density fiberboard, or pre-
   manufactured product containing such materials installed in a building shall comply with the standards of section
   131.14 of the New York City Health Code.

Amendments to the New York City Administrative Code

1. Add a new subchapter to Chapter 4 of Title 20 that is similar in substance and structure to Subchapter 12
   (Endangered or Threatened Species) but contains the following prohibition language:

   Composite wood products. (a) It shall be unlawful to buy or sell, offer or attempt to buy or sell, or cause any person
   to buy or sell any hardwood plywood, particleboard or medium density fiberboard, or pre-manufactured product
   containing such materials, intended for installation in a building, that do not comply with section 131.14 of the New
   York City Health Code on formaldehyde limits.

Supporting Information

Issue – Expanded

Formaldehyde is a colorless, flammable, strong-smelling gas that is often used as a fungicide and germicide. The use of
urea-formaldehyde resins as adhesives by the forest products industry is due to this chemical’s low cost, ease of use
under a wide variety of conditions, low cure temperatures, water solubility, resistance to microorganisms and to
abrasion, hardness, excellent thermal properties, and lack of color.\(^1\)

Materials that contain formaldehyde can release formaldehyde gas into the air. The Environmental Protection Agency
(EPA) classifies formaldehyde as a probable human carcinogen, and the International Agency for Research on Cancer
lists formaldehyde as a known human carcinogen.\(^2\) Formaldehyde was also designated as a toxic air contaminant (TAC)\(^3\)
in California in 1992 with no safe level of exposure.\(^4\) High concentrations of formaldehyde may trigger attacks in people
with asthma.\(^5\) Studies have also found a link between exposure to formaldehyde and increased incidence of nasal
cancer, nasopharyngeal cancer, and leukemia.\(^6\) Exposure to formaldehyde is known to cause eye, nose, and throat
irritation, nausea, fatigue, skin rash, difficulty in breathing and sensitization.\(^7\)

As a volatile organic compound (VOC), formaldehyde also contributes to ground-level ozone formation (smog). When
VOCs are released into the air, the organic compounds react with nitrogen oxides to form ozone. High concentrations of
ground-level ozone can cause respiratory problems and exacerbate asthma, emphysema, and bronchitis. Ground-level
ozone also adversely affects the local ecosystem, damaging or weakening trees and plans, and reducing forest growth
and crop yield.\(^8\)

Environmental & Health Benefits

Limiting formaldehyde in wood products will reduce exposure to a known human carcinogen.\(^9\)\(^10\)

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a high positive health impact per building and to
impact a large number of buildings. It was thus given a health score of 3.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the
context of well-defined construction projects in specific buildings. Where possible, members of the Technical
Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are
presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will
vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in
which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.0%, depending on building type. This proposal
was estimated to increase first capital costs by up to 0.01%, depending on building type. It was thus categorized as not
incurring a capital cost increment.

Precedents

The requirements of this proposal are consistent with regulations in the California Code of Regulations\(^11\) and
formaldehyde limits in the 2008 California Green Building Standards Code.\(^12\)
Numerous federal agencies have established limits on formaldehyde for their own buildings or non-standard housing. The EPA has established a limit of 0.0163 ppm for formaldehyde in its new buildings.\textsuperscript{13} HUD has established a limit of 0.4 ppm for formaldehyde in mobile homes.\textsuperscript{14} FEMA has also established a maximum exposure limit of less than 0.016 ppm for temporary housing units.\textsuperscript{15}

The federal Agency for Toxic Substances and Disease Registry summarized the state of regulation of formaldehyde in 1999 as follows:

Several international, national, and state authorities have established regulations or guidelines for the use and production of formaldehyde. OSHA has established the permissible exposure limit (PEL) 8-hour time-weighted average (TWA) at 0.75 ppm and the 15-minute Short-Term Exposure Limit (STEL) at 2 ppm. The EPA sets regulations for reporting quantities used and how much formaldehyde can legally be produced from automobile exhaust; the FDA also has regulations about the use of formaldehyde in the food you eat.

Non-enforceable guidelines have also been established for formaldehyde. The American Conference of Governmental and Industrial Hygienists (ACGIH) has established a ceiling limit for occupational exposure (Threshold Limit Value [TLV]) of 0.4 ppm. NIOSH has a recommended exposure limit for occupational exposure (8-hour TWA) of 0.016 ppm, and a 15-minute ceiling limit of 0.1 ppm.\textsuperscript{16}

**LEED**

LEED rating systems do not adhere to guidelines denoting a permissible level of formaldehyde. Rather, it is the absence of urea-formaldehyde resins that is required for LEED. While the LEED criteria differ from this proposal, projects complying with the recommendations of this proposal will inevitably find it more feasible to acquire LEED points. However, additional research and attention to product specifications will be required to verify conformance.

The following credits may apply:

- LEED NC-EQ cr.4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products;
- LEED CI-EQ cr.4.4 Low-Emitting Materials, Composite Wood and Laminate Adhesives;
- LEED EB-MR cr.3 Optimize Use of IAQ Compliant Products;
- LEED for Schools-EQ cr.4.4 Low-Emitting Materials;

Although building classified in R-3 occupancy are not included, other residential projects applying under the LEED for Homes rating system may be eligible for credit MR cr.2.

**Implementation & Market Availability**

“No added formaldehyde” products are widely available. Examples of manufacturers who offer alternative building materials in the New York market include Columbia Forest Products,\textsuperscript{17} Homasote and Viroc.\textsuperscript{18} A search on the Columbia Forest Products website identified 4 suppliers within 10 miles of the NYC metro area that carry their products. Twenty businesses were also found to either carry Homasote products or offer assistance with obtaining products within 6 miles of lower Manhattan.

The California EPA website includes a list of over 600 mills that have been identified by a California Air Resources Board (CARB)-approved Third Party Certifier as producers of CARB compliant composite wood products.\textsuperscript{19}

The use of alternative resin binders are also being researched by manufacturers. However, no new products have been identified that can replace urea-formaldehyde (UF) that do not raise some other environmental health concerns.\textsuperscript{20}

**Notes**

The US Department of Housing and Urban Development has set formaldehyde emission standards in manufactured homes,\textsuperscript{21} preempting states and their political subdivisions from enacting such regulations.

Pressed wood products, especially those containing urea-formaldehyde glues, are a major source of formaldehyde. These products are manufactured using urea-formaldehyde resins which are used as interior-grade adhesives in many wood products and in finish coatings applied to hardwood cabinetry and furniture. Such products include particleboard used as flooring underlayment, shelves, cabinets, and furniture; hardwood plywood wall panels; and medium density fiberboard used in drawers, cabinets and furniture. When the surfaces and edges of these products are un laminated or uncoated they have the potential to release more formaldehyde.\textsuperscript{22}

Urea-formaldehyde resins are chemically unstable and can release formaldehyde from unreacted formaldehyde trapped in the resin and from the hydrolytic decomposition of the resin polymer itself. It is the release of the unreacted formaldehyde that is primarily responsible for high initial indoor formaldehyde levels. There does not appear to be a population threshold for the irritant effects of formaldehyde, and sensitization may result in symptom initiation even at low levels of exposure.\textsuperscript{23}

How to quantitatively relate measured air levels of formaldehyde to cancer risk is uncertain. Because many other factors play a role in the development of cancer and because formaldehyde is ubiquitous in the environment, no
definitive level can be established that places humans in a “high-risk” category. The safest way to reduce risk for cancer is to limit exposure. Clinically useful biologic markers, such as blood or urine tests, also are lacking, further complicating the ability to link exposure with outcome. Because formaldehyde plays integral physiologic roles and has a short half-life in the body, determining what is necessary for normal physiologic function and what is excessive and potentially harmful is difficult. In general, the lower the level and shorter the duration of exposure, the lower the risk for cancer and other health effects.24

ENDNOTES:


3 As defined by the California Health and Safety Code § 39655 (2005). (Definition: (a): an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health. California Health and Safety Code, Section 39655 (a): an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health.)


5 Ibid.
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17 Cora Roelofs, et al., Encyclopedia of Earth, Alternatives for Significant uses of Formaldehyde in Massachusetts (2008) http://www.eoearth.org/article/Alternatives_for_significant_uses_of_formaldehyde_in_Massachusetts. (Columbia Forest Products offers a soy-based resin hardwood veneer core plywood panel (Purebond) that can be used to make cabinets, built-in furniture, paneling, shelving, doors and other uses requiring a high end wood product. Purebond is superior to formaldehyde-resin plywood from a health perspective as it eliminates potential formaldehyde exposures for users. However, its production involves use of dichlorohydrin as an intermediate. Dichlorohydrin is classified as a probable human carcinogen and poses other hazards to human health and the environment. This chemical could be a hazard to workers and the environment during production. Both Purebond and formaldehyde-resin plywood exhibit a similar environmental profile with regard to minor ecotoxicity. Technically, Purebond is similar to formaldehyde-containing plywood for the parameters of appearance/construction, fire resistance, and product availability. It has a glue bond superior to that of urea-formaldehyde plywood under conditions of moisture, but its warp resistance has not been fully assessed. Purebond is currently available at a similar cost to formaldehyde-resin plywood.).

18 Ibid. http://www.eoearth.org/article/Alternatives_for_significant_uses_of_formaldehyde_in_Massachusetts (last visited on Jan. 25, 2010). (Homasote and Viroc offer alternatives to softwood plywood panels (Homasote’s recycled paper panel boards and Viroc’s wood fiber Portland cement panels). Neither product presents a health hazard to building occupants, but there are some occupational exposure concerns, such as exposure to wood and cement dust during cutting. Both products are superior to formaldehyde-resin plywood from the perspective of carcinogenicity of the binder. The Homasote panels are superior from the perspective of irritant in binder, while the Viroc panels are similar to formaldehyde-resin plywood on this metric. Both products are superior to formaldehyde-resin plywood from the perspective of ecotoxicity and natural resource conservation. However, the Viroc product is inferior from an energy intensity life cycle perspective. Technical and performance criteria of interest for these uses include strength, weight, response to moisture, storage, handling, fastening, finishing, fire resistance, thermal resistance, and mold, rot and insect resistance. Both alternatives present some advantages and some disadvantages on these metrics. For example, Homasote is superior to formaldehyde-resin panels on several measures including resistance to insects, rot, and mold, and is inferior on certain other measures, such as impact resistance and tensile strength. Viroc is superior on measures including resistance to insects, rot, and mold, fire resistance, and impact resistance, and inferior on parameters such as tensile strength. Both Viroc and Homasote panels must be thicker and heavier than formaldehyde-resin panels to withstand an equivalent load over the same span.).


23 THAD GODISH, AIR QUALITY 357-60 (2d ed. 1990).