Testing composite wood products – a lab perspective

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Marietta, Georgia USA
I. Background
This product contains a lamp(s) which contains mercury; dispose according to local, state, or federal laws.
The Palace of Electricity, 1893 World’s Fair

William Henry Merrill
North America
5,852+ People
65 Locations

Africa, Europe, Latin America, Middle East
3,202+ People
63 Locations

Asia Pacific
5,444+ People
59 Locations

14,495+
ASSOCIATES

185+
FACILITIES
The Definition of Safety is Evolving.

Complex issues of today have replaced concerns of the past. And the safety landscape of tomorrow is yet to be defined.

- Fire and Electrical Safety
- Wireless Testing
- Performance Testing
- Indoor Air Quality
- Chemical Regulations
- Transaction Security
- Renewable Energy
II. Laboratory Needs
A Few Basic Laboratory Needs

• Accreditations
• Testing Equipment
• Knowledgeable Staff
• Test Method/Standards Development
• Robust quality systems
Accreditations

Accreditation bodies in all parts of the world usually use the following ISO/IEC Standards as accreditation requirements:

ISO/IEC 17020 Inspection Bodies
ISO/IEC 17021-1 Management System Certification Bodies
ISO/IEC 17024 Personnel Certification Bodies
ISO/IEC 17025 Testing/Calibration Laboratories
ISO/IEC 17065 Product/Process/Service Certification Bodies
A Few Basic Laboratory Needs

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• Testing Equipment
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Some people have all the fun
Chamber Testing
A Few Basic Laboratory Needs

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Standards, Methods, and Practices

• **Standard** – overall term for denoting that a document was developed by consensus and according to requirements. There are several types.

  - **Standard Test Method** – produces a test result
  - **Standard Practice** – does not produce a test result
  - **Standard Guide** – informational description of a number of options, does not recommend a specific course of action
**Measurement Technology**

**VOC Measurement**
- ASTM D 6196 / ISO 16000-6
- Collect chamber air on Tenax, thermally desorb chemicals and analyze by GC/MS
- Applicable to 1,000’s of chemicals

**Aldehyde Measurement**
- ASTM D 5197 / ISO 16000-3
- Collect chamber air on DNPH and analyze by HPLC
- Primarily for formaldehyde and acetaldehyde
III. Composite Wood Products Emissions Testing
Formaldehyde is a colorless, flammable gas at room temperature and has a strong odor.

Exposure to formaldehyde can cause irritation of the skin, eyes, nose, and throat. High levels of exposure may cause some types of cancers.

One of the primary uses of formaldehyde is in industrial resins and adhesives including those used to make composite wood products.
Hardwood Plywood (HWPW)

Medium Density Fiberboard (MDF)

Particleboard (PB)

Solid Wood (not subject to regulation)

DECREASING RESIN CONTENT ➔
DECREASING FORMALDEHYDE EMISSIONS ➔

9%

0%
Formaldehyde was designated as a toxic air contaminant (TAC) in California in 1992. State law requires ARB to take action to reduce human exposure to all TACs.

The International Agency for Research on Cancer (IARC) classified formaldehyde as "carcinogenic to humans" in 2004, based on the increased risk of nasopharyngeal cancer.

The Air Resources Board (ARB) evaluated formaldehyde exposure and found that one of the major sources of exposure is from inhalation of formaldehyde emitted from composite wood products.
On December 12, 2016, EPA published a rule to reduce formaldehyde emissions from composite wood products.

Composite wood panels and finished products must be labeled as TSCA Title VI compliant by March 22, 2019.

The EPA rule is largely consistent with the existing CARB rule.

EPA includes an exemption from labelling finished products with less than 1 ft² of composite wood.
EPA established a federal system for third party certifiers (TPCs) of panel manufacturers.

EPA approved Accreditation Bodies (ABs) to oversee quality systems of the TPCs.

- ISO 17065 for certification body
- ISO 17020 for inspection body
- ISO 17025 for test laboratories
### TSCA Title VI Formaldehyde Emission Limits

<table>
<thead>
<tr>
<th>Product</th>
<th>Phase 2 Levels (ppm***)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardwood Plywood – Veneer Core</td>
<td>0.05</td>
</tr>
<tr>
<td>Hardwood Plywood – Composite Core*</td>
<td>0.05</td>
</tr>
<tr>
<td>Particleboard</td>
<td>0.09</td>
</tr>
<tr>
<td>MDF</td>
<td>0.11</td>
</tr>
<tr>
<td>Thin MDF**</td>
<td>0.13</td>
</tr>
</tbody>
</table>

* Hardwood plywood panel using particleboard or MDF in the core.
** Maximum thickness of 8 mm.
*** Chamber concentration according to ASTM E 1333 test method.
Third Party Certification Requirements for Manufacturers

- Quarterly Testing by 3rd Party Certifier by Primary or Secondary Test Method
- Quarterly facility inspections and audits of manufacturer records
- Establish Quality Control Manual
- Establish Quality Control Testing for Formaldehyde (one test per shift)
- Train Quality Control Personnel
Primary Test Method – ASTM E 1333

ASTM E 1333 – Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber

01 Test newly manufactured boards

02 Condition boards for 7 days

03 Measure formaldehyde concentration after 16-20 hours in chamber

04 Compare measured chamber concentration to acceptance criteria
Secondary Test Method – ASTM D 6007

ASTM D 6007 – Standard Test Method for Determining Formaldehyde Concentrations in Air from Wood Products Using a Small-Scale Chamber

Equivalence must be determined between small and large chamber test.

Test Method allows significant flexibility in conditioning and chamber time.

The timing should be aligned with ASTM E 1333 to ensure good correlation.
Recordkeeping Challenge
UL Recommendations to Ensure TSCA Title VI Compliance

1. Establish a written policy for TSCA Title VI compliance including vendor risk assessment process.

2. Identify products that contain MDF, particleboard, and/or plywood and keep a file for each vendor including the following:
   - Agreements that ensure TSCA VI compliance
   - Map of supply chain back to panel producer
   - Archived due diligence efforts
   - Statements of compliance for 3 years

3. Risk-based inspection and independent testing of formaldehyde emissions for each vendor.

4. Cultivate list of trusted wood panel producers and use in purchasing requirements.
IV. Case Studies
CARB Standard Operating Procedure for Finished Good Test Specimen Preparation Prior to Analysis of Formaldehyde Emissions from Composite Wood Products:

1. Deconstructive Test Method

Finished product manufacturing process may alter formaldehyde emissions from the panel.

However, testing deconstructed products can be a good indicator with proper context.
2. Loading Factor

8. Test Specimens

8.1 Specimen Size and Chamber Air Change—Chambers are operated at a fixed sample size by varying the make-up air \( (Q) \), or at fixed \( Q \) by varying the product sample size by product type. Either mode is acceptable as long as the appropriate \( Q/A \) ratios for the product type are met (see Table 1).

<table>
<thead>
<tr>
<th>Table 1 Q/A Ratios, ±2 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Q/A ) (m(^3)/h air per m(^2) test area)</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>0.526</td>
</tr>
<tr>
<td>1.172</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1.905</td>
</tr>
<tr>
<td>3.811</td>
</tr>
</tbody>
</table>
3. Mill Example

- A mill takes CARB/TSCA certified panels, applies NAUF glue and veneer to outside, but does not process them further.
  - Is this a laminated panel?
  - Is it a component part?
  - Can they apply for ULEF or NAF exemption from further TPC testing?

The answers to these questions determine make a big difference in a company’s testing burden and timeline for compliance.
Conclusions

• Using a high quality, accredited laboratory is important – details matter!

• Laboratories often end up interpreting regulations, and these interpretations and interaction with SDOs/Regulators help standards evolve

• Regulations and Standards are complex, and evolve over time
THANK YOU