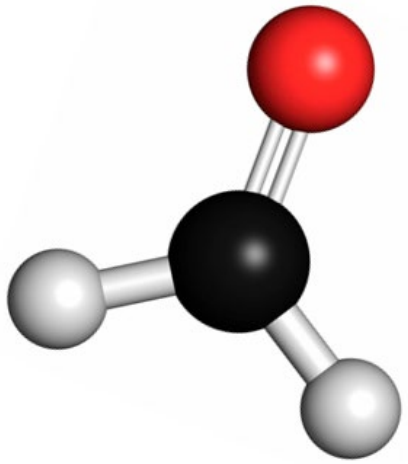
FORMALDEHYDE
WORKSHOP



AHFA Laminated Products Project

Michael Sullivan, Joel Oser, Travis Snapp

February 15, 2023

AHFA
American Home Furnishings Alliance

Benchmark

WOMBLE
BOND
DICKINSON

THE WHY, THE WHEN, THE WHAT AND THE HOW

1. Request for exemption allowed. 40 CFR § 770.4(b).
    1. EPA provided some guidance but no checklist or "how to"
    2. With March 22, 2024 fast approaching it was time to act
2. Successful Request must be *Data Driven* – Show Me
    1. Data to demonstrate cost /benefit of reduction in emissions from resin chemistry
    2. Data regarding formaldehyde emissions related to the request
    3. Data from studies conducted to support exemption request
    4. So AHFA had to go get the data
3. Volunteers Recruited and Testing Laboratories Engaged
    1. Two highly respected labs
    2. Goal: collect data that could not be questioned.

Glue and Glue Application Questions

					Date	
		Company Name				
		Factory				
			Press Line 1	**Press Line 2**	**Press Line 3**	**Press Line 4**
1	***Adhesive(s) used for veneering***					
	Glue Manufacturer					
	Glue Name/Number					
		Type Glue (ex. Urea Formaldehyde, PVA, etc.)				
	Catalyst Name/Number					
	Mix ratio of glue and catalyst					
	What is used to measure and mix the adhesive and catalyst?					
		Automatic measure and mixing machine at the glue spreader	(Yes or No)	(Yes or No)	(Yes or No)	(Yes or No)
		Measure by hand (on a scale) & use an industrial bakers' mixer to mix.	(Yes or No)	(Yes or No)	(Yes or No)	(Yes or No)
		Other - Describe				
2	***Glue application***					
	Type machine for applying and spreading adhesive to panel					
		Manufacture's Name				
		Model #				
		Manufacture Date				
3	***Veneer Press(es)***					
		Used as hot or cold press	(hot or cold)	(hot or cold)	(hot or cold)	(hot or cold)
		Manufacture's Name				
		Model #				
		Manufacture Date				

NOTE: Include copies of all the MSDS Sheets for all adhesives and Catalyst used !

If more lines are use, include a second page showing the next Line numbers

AHFA – EPA TSCA Title VI Laminated Goods Exemption Working Group Proposal

Hypothesis of Experiment:

Due to the process that the furniture industry utilizes for creating laminated panels using UF/MUF resin with low free-formaldehyde content, current production methods will have emission performance comparable to NAF resins (or at least in compliance with ULEF requirements).

Experiment Overview:

Various furniture manufacturers will use their existing global supply chain to prepare laminated goods specimens that will allow us to compare NAF to UF/MUF resins across different panel constructions and manufacturing sites. Prior to selecting the manufacturing sites for this study, information will be collected about the adhesives being used, equipment, and the types of platforms manufactured at each location. Free-formaldehyde testing will be conducted on each laminating adhesive to compare the results among different manufacturing sites. Adhesives for the study will be selected to cover the range of free-formaldehyde levels. Manufacturing sites and panel constructions for each sampling event will be selected to represent a broad cross section of the furniture industry.

For each type of substrate panel, we will conduct 3 sampling events for NAF platforms to serve as a baseline for the study and 7 sampling events for UF/MUF adhesives with varying levels of free-formaldehyde content. Each sampling event will include taking samples of the 1 substrate panel, 3 laminated panels, and the adhesive. Each test sample will be documented with a chain of custody form for traceability. The relevant manufacturing information including substrate details, veneer details, adhesive spread rate, press temp, and press time will be recorded for each sampling event.

Each substrate and laminated panel will be cut into 9 test specimens collected from throughout the panel. The specimens will be tested in 3 groups of 3 according to ASTM D 6007 and averaged to represent the panel. The adhesive sample will be tested in triplicate for free-formaldehyde content according to the acetyl acetone method. Data from the ASTM D 6007 testing will be compared to the EPA criteria for HWPW and the ULEF exemption requirements. ASTM D 6007 results will also be plotted against the free-formaldehyde results for the respective adhesives to determine if correlation is possible

Sampling Plan – What Laminated Products to Analyze

Design for the Experiment:

1. Pre-Inspection Checklist:
   a. What type of Manufacturer would be used for data collection
      i. Domestic Producers who create regulated Laminated Panels
      ii. Foreign Producers who create regulated Laminated Panels
   b. What types of Laminated Panel constructions would be used for analysis
      i. Hardwood Plywood where wood or woody grass veneer face/back are applied
      ii. MDF where wood or woody grass veneer face/back are applied
      iii. PB where wood or woody grass veneer face/back are applied
   c. Current equipment used to create Laminated Panels at each manufacturing facility
   d. Current resin systems used to create Laminated Panels at each manufacturing facility
   e. Current production processes utilized to create Laminated Panels at each manufacturing facility

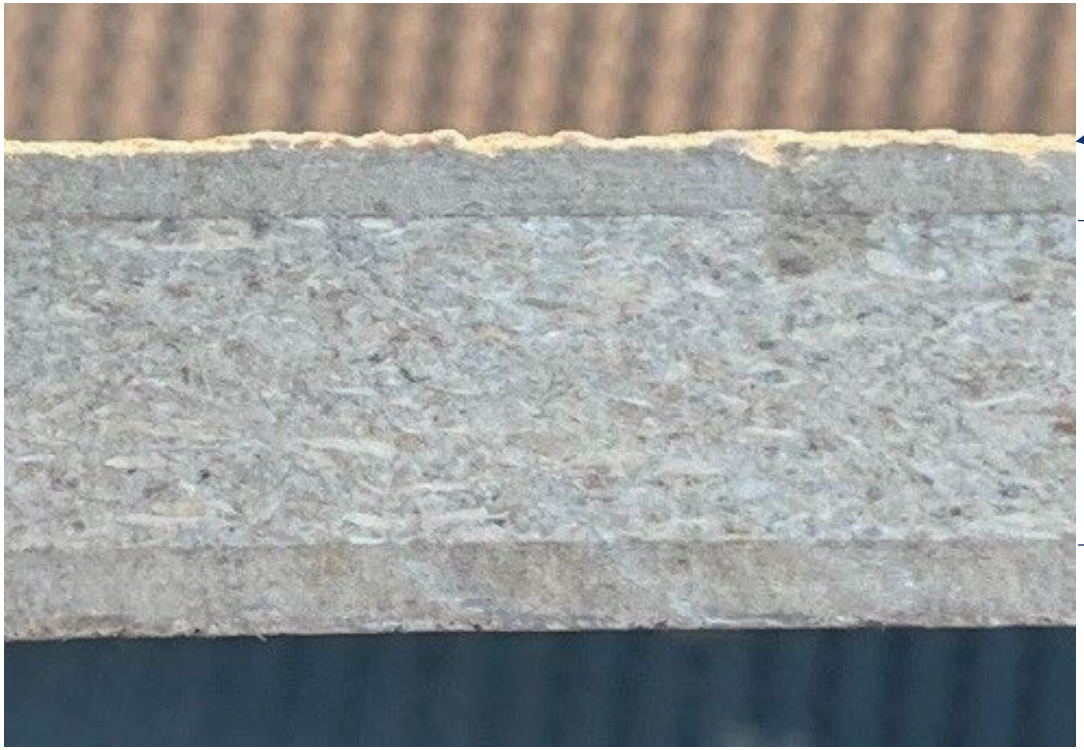
Sampling Plan – What Laminated Products to Analyze

Site Selection:

Company	Company Abbreviation	Location	Platform + Veneer	HWPW-CC Ply	Sampling Lab
1	UL - 1	Vietnam	Cherry/MDF Oak/PB	3-Ply	UL
2	UL - 2	Vietnam	Cherry/PB Oak/MDF	3-Ply	UL
3	UL - 3	Vietnam	Cherry/PB Oak/MDF	3-Ply	UL
4	BMI - 1	United States	Cherry/MDF Oak/PB	3-Ply	BMI
5	BMI - 2	United States	Cherry/MDF Oak/PB	5-Ply	BMI
6	BMI - 3	United States	Cherry/PB Oak/MDF	5-Ply	BMI

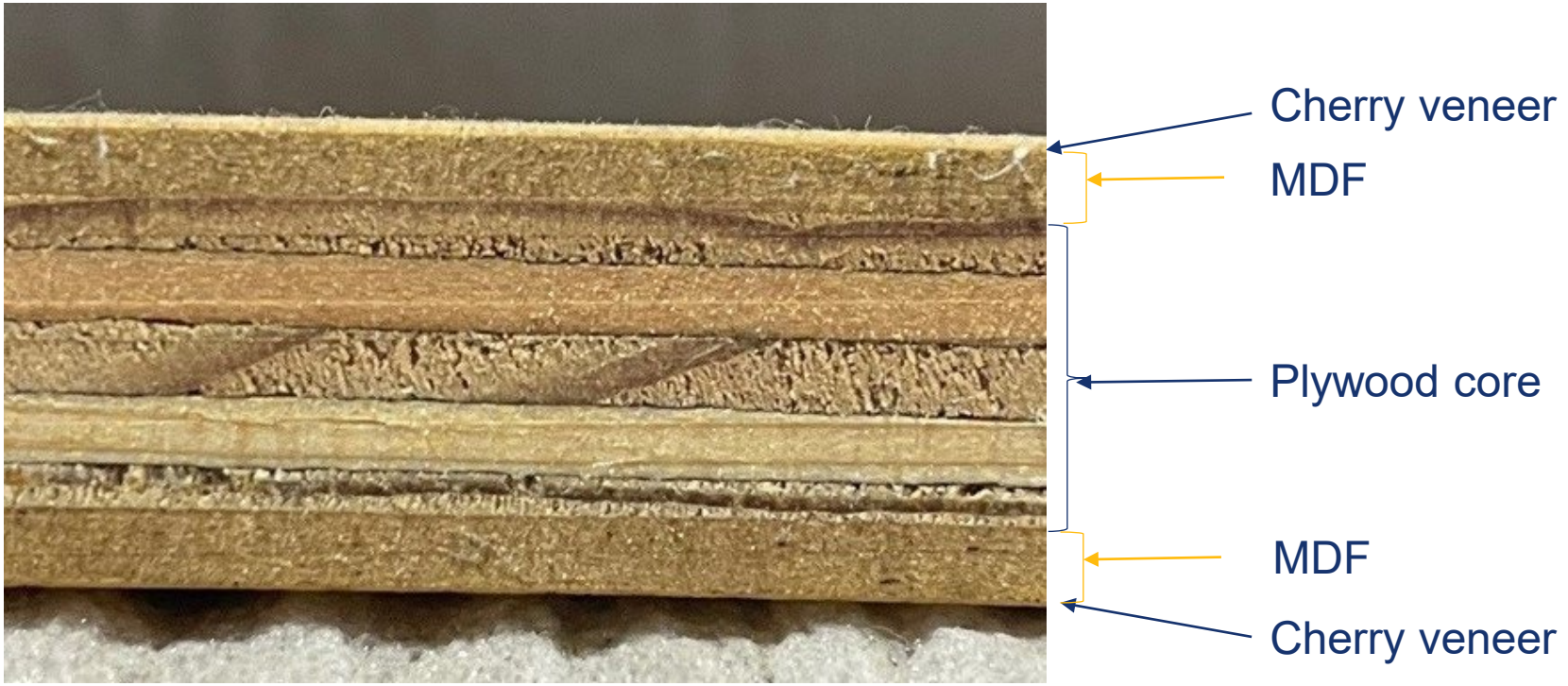
Sampling Plan – What Laminated Products to Analyze

5-Ply Oak Veneer, MDF and Particleboard Core Construction:



Sampling Plan – What Laminated Products to Analyze

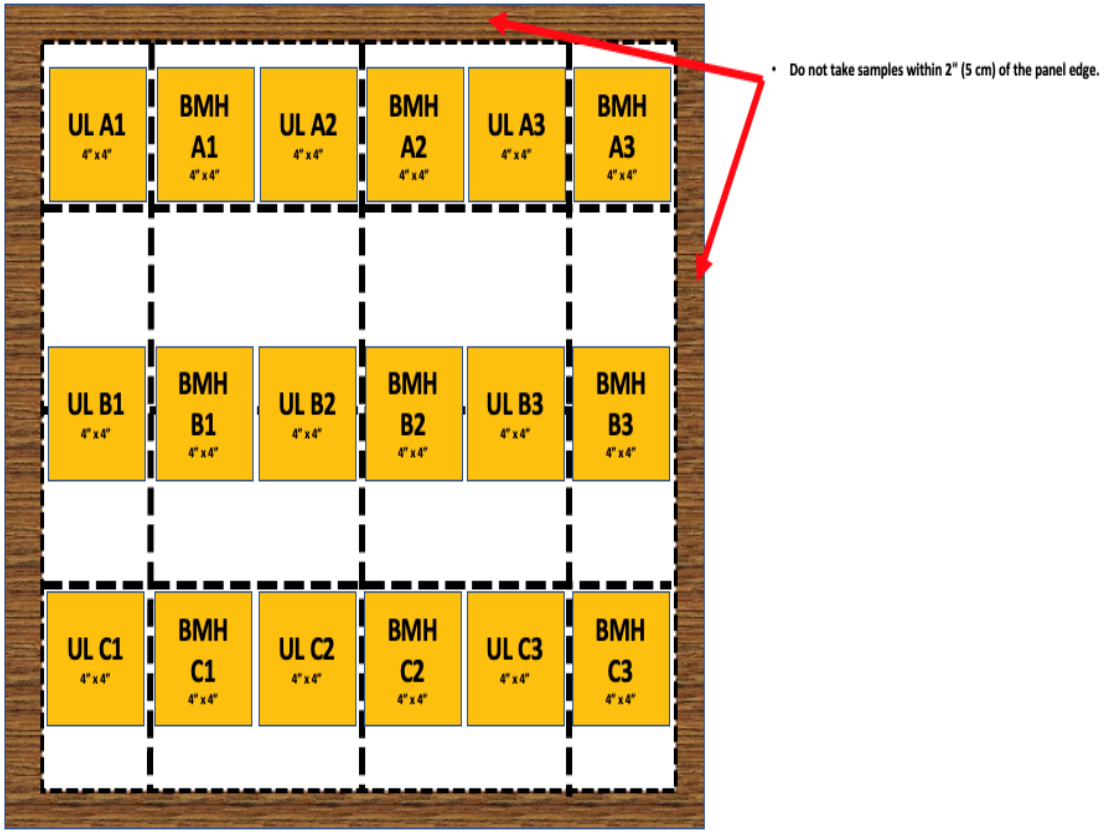
5-Ply Cherry Veneer, MDF and HWPW Core Construction:



Sampling Plan – How Laminated Products Were Collected

Sample Selection:

1. In-Plant Sample Collection:
   a. Dual matched sample collection by each laboratory for analysis
      i. UL responsible for Vietnam sample collection
      ii. Benchmark responsible for US sample collection



Sampling Plan – How Laminated Products Were Collected

Sampling Plan – How Laminated Products Were Collected

Sampling Plan – How Laminated Products Were Received by Each Lab

1. Sample Receipt Verification:
   a. Sample condition, integrity, and proper Chain of Custody
   b. Verify samples meet minimum requirements (size, quantity, etc,)
   c. Record Chain-of-Custody information in laboratory Test Sample Log with unique sample ID, date of receipt, condition, and other information as appropriate
   d. Enter sample into the testing sequence

2. Sample Handling, Storage, and Preservation:
   a. Samples are stored, maintained, and preserved in accordance with governing standards, test methods, and sampling procedures as applicable
   b. Sample security is maintained with limited access to authorized laboratory personnel
   c. Samples are stored after analysis in designate storage areas until the time of disposal or applicable retention period as defined by contract or legal requirements

Sampling Plan – How Laminated Products Were Tested by Each Lab

Designation: D6007 – 22

Standard Test Method for Determining Formaldehyde Concentrations in Air from Wood Products Using a Small-Scale Chamber[1]

This standard is issued under the fixed designation D6007; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method measures the formaldehyde concentrations in air emitted by wood product test specimens under defined test conditions of temperature and relative humidity. Results obtained from this small-scale chamber test method are

responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.6 *This international standard was developed in accordance with internationally recognized principles on standard-*

Sampling Plan – How Laminated Products Were Tested by Each Lab

Table 1
Phase 1 and Phase 2 Formaldehyde Emission Standards for Hardwood Plywood (HWPW), Particleboard (PB), and Medium Density Fiberboard (MDF)[1]

Effective Date	---- Phase 1 (P1) and Phase 2 (P2) Emission Standards (ppm) ----				
	HWPW-VC	HWPW-CC	PB	MDF	Thin MDF
1-1-2009	P1: 0.08	----------	P1: 0.18	P1: 0.21	P1: 0.21
7-1-2009	----------	P1: 0.08	----------	----------	
1-1-2010	P2: 0.05	----------	----------	---------	---------
1-1-2011	----------	----------	P2: 0.09	P2: 0.11	---------
1-1-2012	----------	----------	----------	---------	P2: 0.13
7-1-2012	----------	P2: 0.05	----------	----------	

(1) Based on the primary test method [ASTM E 1333-96(2002)] in parts per million (ppm).
HWPW-VC = veneer core; HWPW-CC = composite core.

Results & Discussion

Mixed results – several samples passed with results meeting the published emission limits. Unfortunately, several samples failed with significant deviation from the published emission limits.

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WOMBLE BOND DICKINSON

www.womblebonddickinson.com
Michael.Sullivan@wbd-us.com

Benchmark

www.benchmark-intl.com
Joel.Oser@benchmark-intl.com

AHFA
American Home Furnishings Alliance

https://ahfa.org