Generic Process, Exposure and Release Scenario K. Franklin
Hardwood Plywood Manufacturing 2-4-91

Process Description: Wood veneer sheets are prepared (preparation does not involve chemicals). Veneer is glued onto imported lauan wood panels using urea formaldehyde (UF) resins mixed with wheat flour in a 1:1 ratio of flour to dry resin. The UF resin is typically 60% resin solids dispersed in water with a small amount of acid added to the resin by the user to catalyze the cure. The panels are then pre-pressed cold (several hours) or hot (100°C for several minutes). Prefinishing operations may include redrying, trimming, sanding, sorting, and storing.

The panels then undergo finishing operations such as printing, paper overlay, vinyl overlay, coating, or varnishing which uses stains, toners, fillers, sealers, and glazes. Surface finishes used on hardwood plywood wall paneling, which constitutes 55% of hardwood plywood use, are: natural hardwood- 18%, printed hardwood- 35%, paper overlaid- 40%, and vinyl overlaid (2 mil film)- 7%.

In a finishing operation for printed wall panels, the panels are first coated with a basecoat, then followed by application of stain, toner coat, filler coat, printed design, sealer and topcoat. All coatings are roll coated or applied by free-falling film coaters. Topcoats are typically alkyd or polyester resins. Oven drying occurs between application steps. The topcoat is cured in gas-fired (93°-110°C) oven. The panels are cooled, buffed, and stacked.

No. of plants	ref.	MMSF Annual Capacity Range	ref.	MMSF Annual Typical Capacity	ref.	Operation Days/yr	ref.
175[a]	(3)	<10 to >100	(2)	10[b]	(2)	250	(2)

Operation	Chemical Usage per MSF board	ref.	Kg use[d] per day
adhesive	41.5 lbs UF resin	(2)	754.5
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adhesive	25 lbs PF resin[c]	(2)	454.5
basecoat	0.65 gallons	(2)	98.4
filler	1.6 gallons	(2)	242.3
print ink	0.1 gallons	(2)	15.1
sealer	0.35 gallons	(2)	53
topcoat	0.65 gallons	(2)	98.4

[a] All but two plants use imported wood blanks.
MMSF: million square feet of wood plywood, 3/8" thick.

MSF: thousand square feet of wood plywood, 3/8" thick.

[b] 78 plants have less than 10 MMSF annual capacity.

[c] Currently no hardwood plywood plants use phenol formaldehyde (PF) resins.

[d] $$\frac{\text{lbs}}{1000\text{ sq ft}} \cdot \frac{\text{kg}}{2.2\text{ lbs}} \cdot \frac{10{,}000{,}000\text{ sq ft}}{\text{year}} \cdot \frac{\text{year}}{250\text{ days}} = \frac{\text{kg}}{\text{day}} \text{ or } =$$

$$\frac{\text{gallons}}{1000\text{ sq ft}} \cdot \frac{8.33\text{ lbs}}{\text{gallon}} \cdot \frac{\text{kg}}{2.2\text{ lbs}} \cdot \frac{10{,}000{,}000\text{ sq ft}}{\text{year}} \cdot \frac{\text{year}}{250\text{ days}}$$

Hardwood plywood plant usually operate with 3 shifts/day, 8 hours/shift, 24 hours/day, and 50 weeks/year. The number of workers per shift given in the table below are for a larger size plant (100 MMSF capacity). For a smaller, more typical size 10 MMSF plant, perhaps 2 workers per shift would be involved with glue spreading and perhaps 5 workers/shift involved with coating and surface finishing operations.

Operation	Avg. number of workers per shift	ref.
Make veneer	4	(2)
Drying veneer	17	
Veneer preparation	8	
Glue spreading	10	
Pressing	4	
Sawing, sanding	12	
Shipping	1	
Forklift	5	
Coating/surface finishing	10	

Even though the formaldehyde resins used are water dispersable, it is assumed that there are no water releases from use and cleanup of vessels of the resin. There is no information available concerning water releases from this operation, so this assumption is based on professional judgement. Water effluent regulations (40 CFR Part 429) seem to indicate that no process wastewater are allowed to be discharged into navigable waters.

REFERENCES: Hardwood Plywood Production

(1) 1990 Annual Capacity Survey- Particleboard and Medium Density Fiberboard Industry. National Particleboard Association, Gaithersburg, MD. January, 1990.

(2) Cost Analysis of Options for Controlling Formaldehyde Emissions from Wood Products. Draft Report. ICF, Inc. Washington, DC: USEPA, OTS, ETD. March 21, 1986.

(3) US Wood Panel Production and Estimated Resin Use- 1988. (2 page handout). National Particleboard Association. Gaithersburg, MD. August, 1989.

KF- Hardwood Plywood Manuf

1) say that Lauan is a soft textured philippine timber such as Phillippine mahogany

2) Why 250 d/yr of operation. If plants operate 50 weeks per year 24hrs/day in 3 shifts it seems they would operate ~ 350 d/yr with workers working 250d/yr

3) put ~~the~~ ave # of wkrs/shift for the "typical plant in the same table as the one for the largest plant

4) 40 CFR Part 429.131 states ~~that~~ that there shall be no discharge of process wastewater pollutants into navigable waters. This applies to the entire finishing category/operations. This document doesn't give the same impression.

5) If plants operate 350 d/yr rather than 250 the amts of material used/day would change

6) Use worksheet format