

Airborne Toxic Control Measure on Composite Wood Products

Public Workshop

June 20, 2006

1001 I Street
Sacramento, California



California Environmental Protection Agency

Air Resources Board

Meeting Agenda

- Background on ATCM
- Update on Regulation Order
- Performance Standards–BACT Assessment
- Health Risk Assessment
- Enforcement Provisions
- Economic Impacts
- Comments on Regulation
- Next Steps



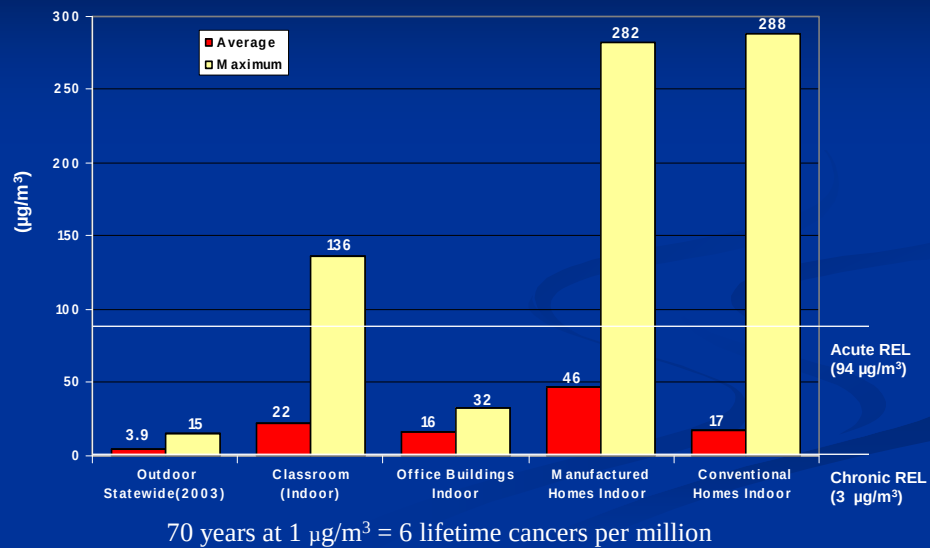
California Health & Safety Code Requirements

- § 39657 – Requires ARB to identify toxic air contaminants; identify minimum threshold level if any
- § 39658 – Requires ARB to develop Air Toxic Control Measures (ATCMs)
- § 39660.5 – Requires ARB to assess California's indoor exposure to toxic air contaminants (TACs) and the relative contribution to total exposure
- § 39665 – Requires ARB to prepare a report on the need and appropriate degree of regulation
- § 39666 – For compounds with no threshold level, the HSC requires the development of control measures based on best available control technology, or more effective controls in consideration of costs and risk

Why is Formaldehyde a Concern in California?

- ARB Identified as TAC in 1992; no safe threshold
Nasopharyngeal cancer: URF = 6 cases/million
(1 $\mu\text{g}/\text{m}^3$, 70 years exposure)
- Formaldehyde identified as a HAP by the U.S. EPA
B1 cancer classification – probable human carcinogen
Nasopharyngeal cancer: URF = 13/million
(1 $\mu\text{g}/\text{m}^3$ per 70 year exposure)
- Classified as Group 1 by IARC – known human nasopharyngeal carcinogen
- Acute eye irritation over 94 $\mu\text{g}/\text{m}^3$ (1 hr. avg. aREL)
- Chronic respiratory health problems over 3 $\mu\text{g}/\text{m}^3$ (annual avg. cREL)

What are Typical Formaldehyde Levels?



Emissions and Exposure

- Statewide formaldehyde emissions
 - TPY
 - Mobile sources – 16,185 (77%)
 - Stationary Sources – 2,871 (14%)
 - Area sources – 1,976 (9%)
- Exposure levels
 - 2004 statewide average ambient – 3.3 µg/m³
 - Indoor air range – 16 to 290 µg/m³

Why Composite Wood Products?

- Risk levels due to formaldehyde are elevated
 - SB 25 (Tier II)– Children's Environmental Health Protection Act
- CWPs contribute to outdoor concentrations (shipping, inventories, potential near source)
- Major source of personal exposure to formaldehyde
 - Formaldehyde levels indoors typically 2 to 10 times those outdoors
 - Over 85% of time indoors for most Californians
 - More than 90% of exposure to formaldehyde occurs indoors
- Opportunity to reduce formaldehyde exposures

Update on Regulation Order

ATCM Regulation Order

- Draft Released on May 1, 2006
- Suggestions were received at a number of public and one-on-one meetings with stakeholders
- A limited number of written comments were received

Issues Raised

- Technology assessment – Phase 2 Standards
- Proposed emission standards – need for mfg. flexibility
- New emission standard– Composite–core HWPW
- Implementation schedule
- Enforcement to maintain “level playing field”

Issues Raised (cont'd)

- Exemption for non-UF resins
- Specific text regarding HUD federal pre-emption
- Requirements for Third Party Certification
- Chain-of-custody requirements
- Timing of regulatory development

ATCM Revisions

- Adjusted cap performance stds. to account for process variability
- Exclusion for non-UF resins under phase 1 requirements
- Proposing new std. for composite-core HWPW
- Clarified language relative to products subject to the HUD standards
- Added specificity to delineate violations of the ATCM

ATCM Revisions (Cont'd)

- Added language on the structure of the emission standards
- Added specificity for Third Party Certification
- Added specificity to recordkeeping requirements
- Identified other chain-of-custody programs that comply with the ATCM requirements

Performance Standards

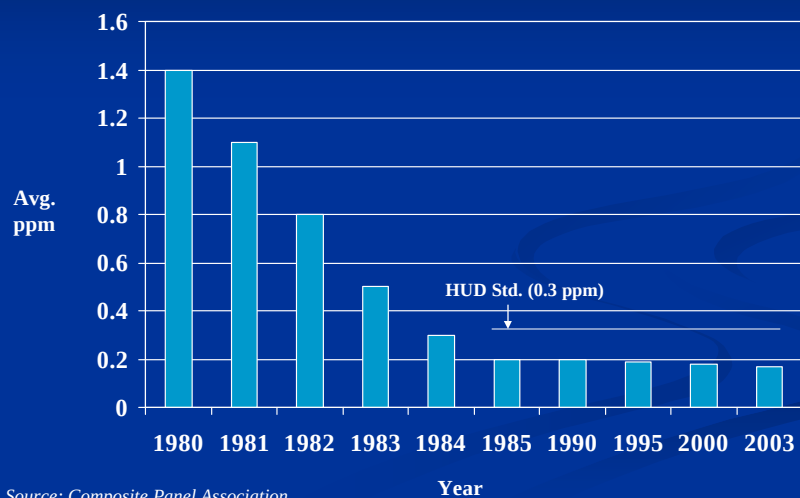
Best Available
Control Technology
(BACT)
Assessment

Best Available Control Technology Evaluation

H&S Code Section 39666 requires ARB to reduce emissions through application of best available control technology, or a more effective control method, considering technological feasibility and cost

- 2002 product survey
- Personal contacts
- ARB research— patent searches, technical literature
- Evaluation of manufacturing processes— site visits, technical literature, ARB survey

Historical Formaldehyde Emissions from Particleboard



2002 Composite Wood Product Survey

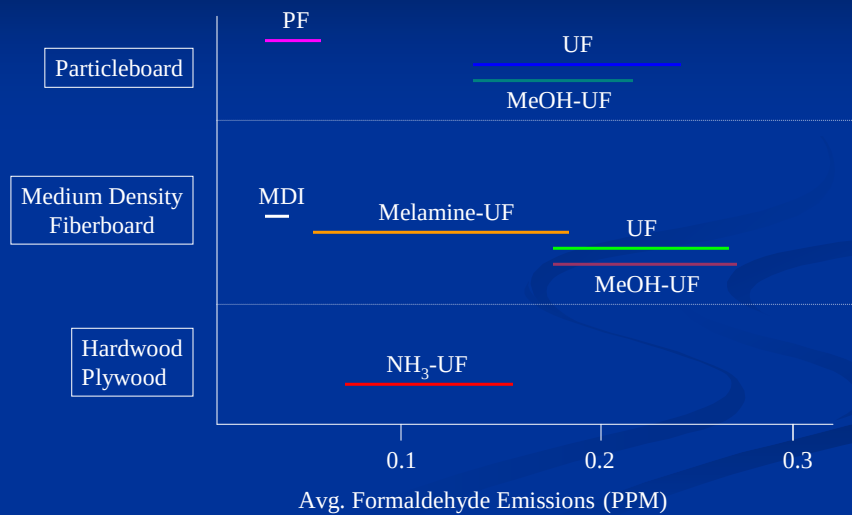
- Nationwide Distribution (37 Major Producers)

	<i>Annual Production ($\times 10^6$ M³)</i>		
	ARB Survey	Industry reference	% Response
Particleboard	5.1	9.6	53
MDF	2.9	3.5	83
HWPW	1.3	1.8	73

2002 CWP Survey *Manufacturing Process*

- Manufacturing flowcharts very similar
- Variation in process equipment mfrs. & vintage
Plant closures have led to reuse of old equipment
- Presses
Different types in use today (multi-opening, continuous, steam heated, conventional)
- Blenders
Older equipment have basic designs
Newer models have lower maintenance; resin use savings
- Four mfrs. reported HCHO post treatment

2002 CWP Survey- *Resin Use*



2002 CWP Survey *Resin Systems*

- UF (52% of responses reported use)
 - ~20% use low UF co-blends
 - ~30% use catalysts & scavengers
 - ~8% use post treatment
- UF-MeOH (27% of responses reported use)
 - 50% use low UF co-blends
 - 50% use catalysts
 - ~30% use scavengers
- AUF (19% of responses reported use)
- MUF (10% of responses reported use)
- PF (8% of responses reported use)
- PRF (4% of responses reported use)
- MDI (2% of responses reported use)

Median avg. HCHO Concentrations

2002 ARB Survey

	Median of avg. HCHO concentrations
Particleboard	0.18 ppm
Medium Density Fiberboard	0.25 ppm
Hardwood Plywood	0.09 ppm

Worldwide Standards for Wood-Based Panels

- United States
 - 1985 HUD standards; voluntary
 - New ASTM/ANSI specifications under review
- Europe
 - E1 standards for plywood and particleboard are about half of the HUD standards
- Japan (F** – F****)
 - F*** standard is stringent, technology-forcing for some products
 - F**** standard represents de minimis levels

Proposed Standards

Phase 1

	Proposed Std. (ppm)	Mfgs. meeting proposed std.
	Effective Date	
Particleboard	0.18	45%
	July 1, 2008	
Medium Density Fiberboard	0.21	40%
	July 1, 2008	
Hardwood Plywood	0.09	85%
	July 1, 2008	

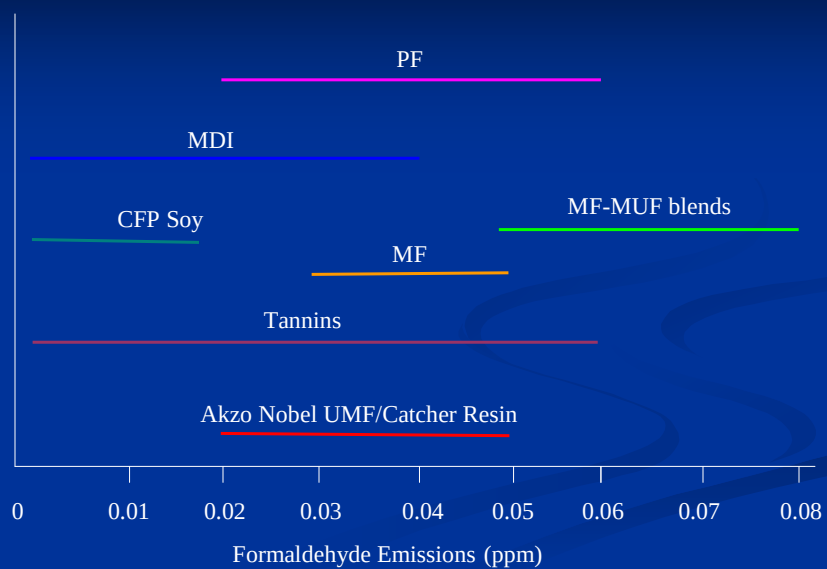
BACT for Phase 1 Compliance

- Low F/U molar ratio copolymer blends
- Adjust UF resin additives
 - scavengers
 - catalysts

Proposed Standards *Phase 2*

	Proposed Standard (ppm)	Effective Date
Particleboard	0.08	July 1, 2010
Medium Density Fiberboard	0.08	July 1, 2012
Hardwood Plywood	0.03	July 1, 2010

Low Formaldehyde Resin Technology



BACT for Phase 2 Compliance

Particleboard and MDF

- MUF resin/catcher system
 - low F/U molar ratio
- PF
- MDI
- Tannin technology

BACT for Phase 2 Compliance

Hardwood Plywood

- MDI
- PVA
- Soy-based
- PF
- MUF-UF blends
- MUF/catcher

Closing Comments

Phase 1

- Creates products for California comparable with international standards

Phase 2

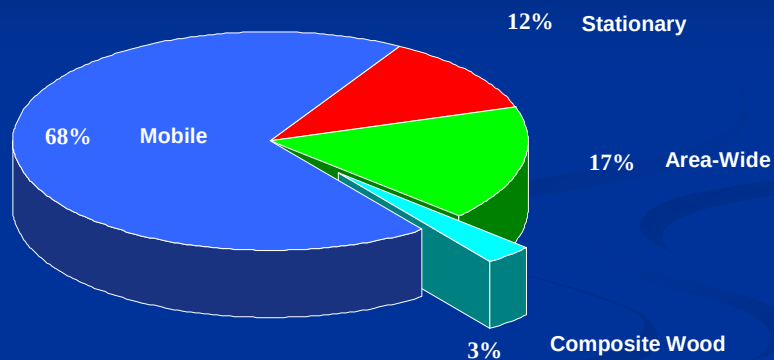
- Technology forcing

Health Risk
Assessment

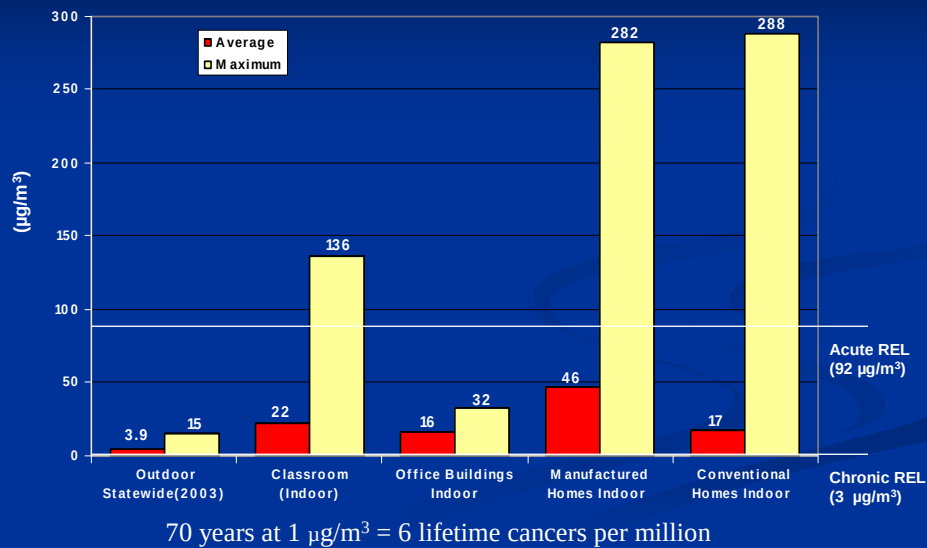
HCHO Exposure and Risk

- Exposures to HCHO occur continuously throughout the day
- Health risks are due to cumulative exposures that occur when people breathe HCHO in indoor and outdoor settings
- Exposure assessment requires consideration of activity patterns to see where/when exposures occur

Outdoor Sources of HCHO Emissions



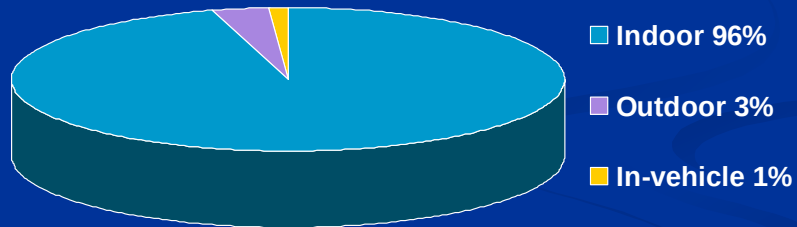
What are Typical Formaldehyde Levels?



Daily Activity Patterns

- On average, people spend 85% or more of each day indoors
- HCHO concentrations are considerably higher indoors vs. outdoors
- HCHO concentrations from composite wood products lead to direct human exposure

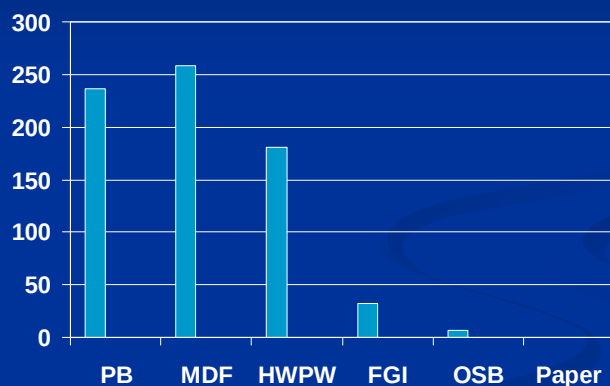
Average Daily HCHO Exposure



Outdoor Risk

- Some HCHO emissions that originate indoors end up outdoors
- Potential “hot spots” or near-source locations may be of concern
- CARB modeling estimate of emissions from a lumberyard
 - Est. excess cancer risk = 3 per 10-million

HCHO Emission Rates from Selected Products ($\mu\text{g}/\text{m}^2/\text{hr}$)



CARB Risk Assessment

- Based on how much a person's total daily HCHO exposure is reduced by the ATCM
- Key inputs are time spent in different locations and representative HCHO concentrations
- Total daily HCHO doses are calculated and time-weighted average HCHO concentrations determined
- Cancer risk is calculated as a function of time-weighted average HCHO concentration
(Risk = ΔHCHO concentration $\times$ Unit Risk Factor)

Daily HCHO Exposure -- Child

Location	Time (hr)	HCHO ($\mu\text{g}/\text{m}^3$)	Exposure (%)
In-home	14	17.2	59
In-Other	6	24.6	37
Outdoors	3.5	3.7	3
In-vehicle	0.5	9.6	1
<i>Total</i>	<i>24</i>	<i>-----</i>	<i>100</i>

Estimated Changes in HCHO Concentrations

Location	Baseline ($\mu\text{g}/\text{m}^3$)	Phase 1 ($\mu\text{g}/\text{m}^3$)	Phase 2 ($\mu\text{g}/\text{m}^3$)
In-home	17.2	14.1	8.6
In-other	24.6	21.7	16.4
TWA-In	19.4	16.4	10.9
TWA-Daily	16.9	14.4	9.9

Benefits of the ATCM

- Reduces the total potential HCHO emissions from composite wood products – effective pollution prevention
- Greatest reductions occur in indoor settings where people spend most time
- Achieves slight reductions in toxic and criteria pollutant emissions to ambient air
- Would reduce excess cancers by 15% (phase 1) to 40% (phase 2) from current day exposures

Enforcement Provisions

ARB Enforcement Program *Overview*

- Comprehensive and effective enforcement needed to maintain “level playing field”
 - Current HUD Std. results in “cheating”; no current enforcement of non-compliant off-shore production
- Raw boards enforcement
- Finished product enforcement

Proposed ATCM Enforcement Program

- Need new infrastructure for effective enforcement
 - Personnel needs
 - Field test apparatus–
 - Small chamber for ASTM D6007
 - ◆ Evaluate applicability to finished products
 - Other field instruments (eg. portable HCHO detector)
 - ATCM stds. validation– Large chamber for ASTM E 1333
 - Contract testing; ARB large chamber (requires funding)

ARB ATCM Enforcement Approach

- Direct enforcement activities at facilities
 - Testing; audits (chain-of-custody/records)
- Potential enforcement under ARB's program on ports
- Joint enforcement activities with USEPA, US customs and local air pollution control districts
- Work with the CA. bldg commission to integrate CWP ATCM stds. into building permitting requirements (eg. windows, doors and cabinets)
- Follow up on complaint hotline

CWP ATCM Enforcement *Raw Boards*

- Enforcement at mfg. plants– 3rd party certification
 - Provides ARB oversight at any point of CWP mfg, distribution and retail
 - Laboratory certification (domestic and international)
- Enforcement at distribution, fabricator and retail
 - ARB enforcement approach

ARB Enforcement Approach

Raw Boards

- Used by ARB to conduct enforcement activities
- Elements
 - Sampling procedures by staff (applies to mgfrs., distributors, fabricators & retailers)
 - Testing and analytical methods
 - Field apparatus– Small chamber
 - Regulatory Standard– Large Chamber
 - Specificity regarding acceptable analytical methods
 - Chain-of-custody requirements for enforcement samples

CWP ATCM Enforcement

Finished Products

- Chain-of-custody
- 3rd party certification program for finished products?
- Enforcement activities will target companies responsible for most finished products in CA
- Enforcement activities will target imported furniture as major source of imported CWPs
- Screening method

Economic Assessment

Economic Analysis

Government Code Section 11346.3 requires state agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any regulation

Affected Businesses

- Composite Wood Manufacturers
- Resin Producers
- Fabricators
- Distributors
- Retailers
- Consumers

Manufacturer Costs

- Additional research and development in manufacturing technology
- Upgrading or converting existing plants to accommodate a new resin system (e.g. mixer/spreader)
- Added investment in QA/QC systems
- Additional product emission testing by a certified lab
- Higher resin cost
- Recordkeeping

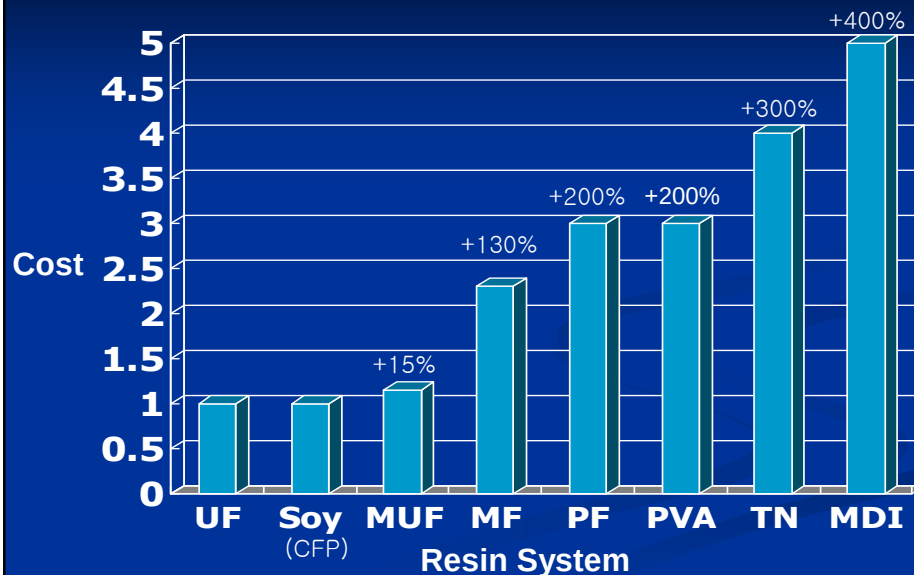
Manufacturing Cost Analysis

Total Δ Manufacturing Cost =

Δ Resin Cost + Δ Capital Cost +
 Δ Production Rate Cost +
 Δ Energy Cost

Total cost will vary from company to company depending on current production capabilities

Resin Compared to UF Costs



Capital Cost

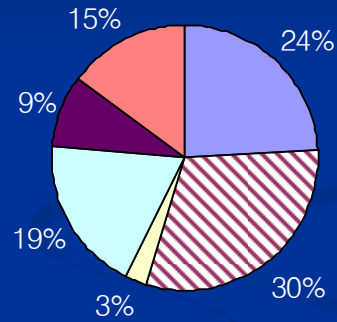
- Plant modifications required
 - Blenders
 - Resin Tanks
 - Furnish Drying Capacity
- Degree of modification differs from plant to plant for both Phase 1 and Phase 2

Resin Energy Cost and Production Rate *Compared to UF*

	Press Time	Press Temp	Net energy Cost	Production Rate
UF	Standard	Standard	<u>Standard</u>	<u>Standard</u>
MUF	Longer	Higher	<u>Increase</u>	<u>Decrease</u>
PF	Longer	Higher	<u>Increase</u>	<u>Decrease</u>
PMDI	Standard	Standard	<u>Standard</u>	<u>Standard</u>
Soy	Standard	Standard	<u>Standard</u>	<u>Standard</u>
PVA	Shorter	Lower	<u>Decrease</u>	<u>Increase</u>

Distribution of Particleboard Manufacturing Cost

- 1 Net wood cost – 24 %
- 2 Adhesive – 30 %
- 3 Wax – 2.6 %
- 4 Labor – 18.9 %
- 5 Electricity – 8.6 %
- 6 Supplies/ Misc.- 14.6 %



Source: Resource Information Systems Inc.

Wood Products Review, 1997

Cited in Canadian Forest Industries Wood-Based Panel
Products: Technology Roadmap II. Panels in Perspective Table 2

Regulation Cost Estimate Particleboard

Current Wholesale Cost

- \$6.88 ^{1/} per 4' x 8' sheet
- 30% is resin cost: \$2.06

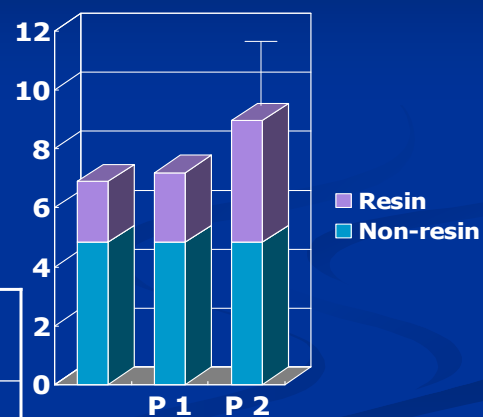
Phase 1

Resin Cost Increase by 15%

Phase 2

Resin Cost Increase by 100%

	Current Wholesale \$6.88	Overall Increase %
Phase 1	\$7.19	+ 4.5%
Phase 2	\$8.94	+ 30 %



^{1/} Random Length Price

Distribution of MDF Manufacturing Cost

1 Net wood cost – 29%

2 Adhesive – 27%

3 Wax – 3%

4 Labor – 15%

5 Electricity – 10%

6 Supplies/ Misc.- 16%

1

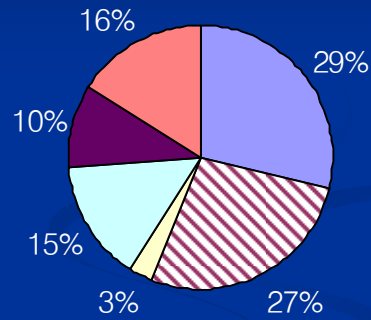
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3

4

5

6



Source: Resource Information Systems Inc.

Wood Products Review, 1997

Cited in *Canadian Forest Industries Wood-Based Panel Products: Technology Roadmap II. Panels in Perspective Table 2*

Regulation Cost Estimate MDF

Current Wholesale Cost

- \$9.60 ^{1/} per 4' x 8' sheet
- 27% is resin cost: \$2.59

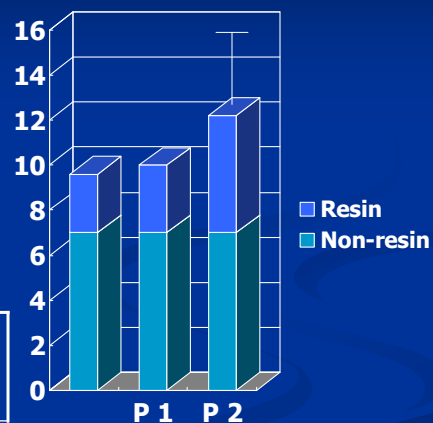
Phase 1

Resin Cost Increase by 15%

Phase 2

Resin Cost Increase by 100%

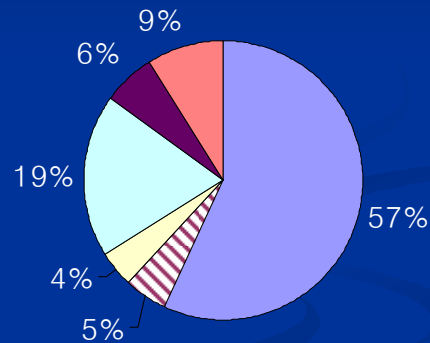
	Current Wholesale \$9.60	Overall Increase %
Phase 1	\$9.99	+ 4 %
Phase 2	\$12.19	+ 27 %



^{1/} Random Length Price

Distribution of Hardwood Plywood Manufacturing Cost

- 1 Wood – 57%
- 2 Adhesive – 5%
- 3 Maintenance – 4%
- 4 Labor – 19%
- 5 Electricity – 6%
- 6 Supplies/ Misc.- 9%



Source: United States Dept. of Agriculture

General Technical Report FPL-GTR-90

Capacity, Production, and Manufacture of Wood-Based Panels in the United States and Canada

Regulation Cost Estimate Hardwood Plywood

Current Wholesale Cost

- \$40 per 4' x 8' sheet
- 5 % is resin cost: \$2

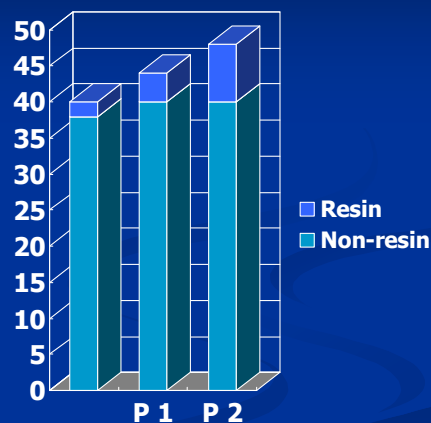
Phase 1

Resin Cost Increase by 200% (PF)

Phase 2

Resin Cost Increase by 400% (PVA)

	Current Wholesale \$40	Overall Increase %
Phase 1	\$44	+ 10 %
Phase 2	\$48	+ 20 %



Resin Producers

- Most resin companies provide wide array of resins
- Resin prices are mainly affected by the cost of raw materials
- Technical assessment for Phase 2 stds.
- Incremental cost of resin production to be passed to manufacturers

Cost to Fabricator, Distributors, Retailers

- Cost of non-compliant products after implementation
- May incur some costs to develop a tracking system to document purchases and sales
- Costs may be likely passed on to consumers

ATCM Consumer Cost

- Kitchen Remodel Example
 - Remodeling with compliant products will cost \$90 more for end users
- Staff also developing incremental consumer price for new house and furniture

Next Steps

Public Workshop	June 20, 2006
2 nd Public Workshop	Mid-July
45-day Comment Period	August 11, 2006
Board Hearing	September 28-29, 2006



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