Airborne Toxic Control Measure on Composite Wood Products

Public Workshop

October 23, 2006

1001 I Street
Coastal Hearing Room
Sacramento, California

California Environmental Protection Agency
Air Resources Board

Meeting Agenda

- Regulation Order
- Health Risk Assessment
- BACT Assessment
- Enforcement Provisions
- Emissions Inventory
- Economic Impacts
- Open Session for Comments
- Next Steps

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Update on Regulation Order

Background

- Previous versions of the draft regulation were released in May and June 2006
- In July-October, staff met with various manufacturers and associations to discuss aspects of the draft regulation
- Written and verbal comments received from CWIC, Jeld Wen, Columbia Forest Products, SierraPine, Timber Products, Window & Door Manufacturers Assn, American Home Furnishings Alliance, Stanley, Broyhill, Woodwork Institute, Armstrong Flooring, and numerous fabricators

Revisions to the Draft Regulation

- Modified selected definitions to improve clarity and provide specificity
- New standards for HWPW-veneer core and HWPW-composite core
- Third Party Certification requirements to be set forth in a CARB document
- Updated sell-through provisions to reflect changes in performance standard effective dates

Revisions -- Continued

- Separate provisions for distributors and importers
- Created a separate test methods section:
  - ASTM E1333 testing by panel manufacturers
  - Placeholder for CARB enforcement methods
    - Small chamber raw panel testing
    - Finished product screening method

Phase 1: HWPW-Veneer Core

- 2002 Survey: 85% at 0.09 ppm; 20% at 0.07 ppm
- All manufacturers used ammonia-UF resins with F:U ranging from 1.7 to 2.0
- Options for lowering HCHO: dryers, lower F:U ratio resins (e.g., 1.1), hardeners
- Use of hardeners appears highly effective
- Manufacturers can do more to reduce HWPW emissions

Phase 1: HWPW-Composite Core

- Should be higher than the performance standard for HWPW-Veneer Core
- Has an effective date after the Phase 1 standards for particleboard and MDF
- Exclusive use of AUF resins indicated; alternatives had not been widely explored
- 0.09 ppm was retained due to lack of robust data to demonstrate infeasibility
  - Comments?

Discussion Items

- Duration of proposed sell-through periods
- Performance-based vs. technology-based exemptions for Phase 1 products
- Need for additional specificity in the chain-of-custody requirements
- Requirements for Third Party Certification Programs and Third Party Certifiers
- Other issues

Update on Health Risk Assessment

Background

- The first preliminary draft was released for comment at the June 20, 2006 workshop
- Concerns were expressed relative to the use of a 70-year exposure duration for children
- Risk was estimated by multiplying the time-weighted average formaldehyde concentration by the cancer unit risk factor

Formaldehyde Exposure Levels ($\mu g/m^3$)

Location	Mean	Maximum
Homes	17	285
Classrooms	22	135
Offices	16	32
In-vehicles	10	15
Outdoors	4	19

Calculation of Formaldehyde Exposure Concentration

- Calculated a daily time-weighted average
- References for exposure concentrations
  - CARB (2005) Report to the Legislature
  - Research Triangle Institute (1998)
  - Sherman and Hodgson (2002)
- References for activity pattern data
  - University of California, Berkeley (1991)

Summary of Revisions

- Used the “Hot Spots Program” equation for inhalation dose ($Dose_{inh}$)
- Estimated cancer risk in children and adults using 9-year and 70-year durations
- Risk in average and elevated exposure scenarios were estimated by applying OEHHA’s cancer potency factor

Revised Risk Estimates

- Children: estimated chances per million of developing cancer ranged from 22 to 62 based on a 9-year exposure duration
- Adults: estimated chances per million of developing cancer ranged from 86 to 231 based on a 70-year exposure duration
- Adoption of the Phase 1 and Phase 2 standards would reduce estimated cancer risk by 17% and 46%, respectively

Update on BACT Assessment

BACT Assessment Update

- Growing list of commercial panels meeting Phase 2 requirements
- Growing list of commercial resin systems meeting Phase 2 requirements
- Viable future resin technologies

Commercially Available Composite Wood Panels

Tradename	Manufacturer	Wood Products	Resin System
Medite II, Medex, and Arreis	SierraPine	MDF	MDI
Purebond	Columbia Forest Products	HWPW	Soy-based
Purekor-Particleboard Plus/MDF Plus	Panel Source International	PB, MDF	MDI
Purekor-FSC Plywood Plus	Panel Source International	HWPW	PF
Skyply*	Roseburg	HWPW	PF
Skyblend	Roseburg	PB	PF

*Phase 2 compliance not confirmed

Commercially Available Resin Systems

Tradename	Company	Wood Products	Resin System
EcoBind Resin System	Hexion	HWPW, PB, MDF	MUF + co-reactants, PF, Soy/PVA blend
Kenocatch Catcher System	Akzo Nobel	MDF, PB	MUF + catcher
Rubinate & Suprasec Resin System	Huntsman	PB, MDF	Polyurethane & MDI
ReacTite EP-925	Franklin Chemical	HWPW	PVA

Future Resin Developments

Resin	Reference
Phenol-UF	Zhao et al., 1999
Phenol-UF-Tannin	Vazquez et al., 2004
Cashew Nut Shell Liquid	A. Pizzi, 2006
MDI Hybrids (UF, PF, MUF, PMUF)	Lei et al., 2006
Soyad® PF/Soy blend	http://www.heartlandresource.com/

Future Resin Developments
Phenol-UF Resins

- Low to zero-formaldehyde emissions
- Trials being conducted on PB, MDF, HWPW
  - Ohyama et. al., 1995; Zhao et al., 1999; Vazquez et. al., 2004
- Press times as fast as UF resins with accelerator
- Mechanical strength better than PF resins
- Commercialization mentioned in Zhao, et. al., 1999
- Costs unknown at present

Future Resin Developments
MDI Hybrid Resins

- Commercially available in Europe
- Upgrades traditional wood adhesives
- Enhanced mechanical performance
  - Wet and dry internal bond strengths increase

Summary

- Technology already exists to meet Phase 2 standards
- Resin companies appear to be focusing on Phase 2 standards
- Future resin technology is promising

Update on Enforcement

Enforcement Related Activities

Since June 20th Workshop

- Internal coordination between enforcement and laboratory
- Initiate planning for ARB raw panel testing
- DHS coordination
- Various tours
  - Door manufacturers
  - Oakland port
  - Architectural plywood
  - DHS laboratory
- Initiate industry coordination for finished product screening test development
- Evaluation of chain of custody requirements
- Meeting with Chinese Consulate

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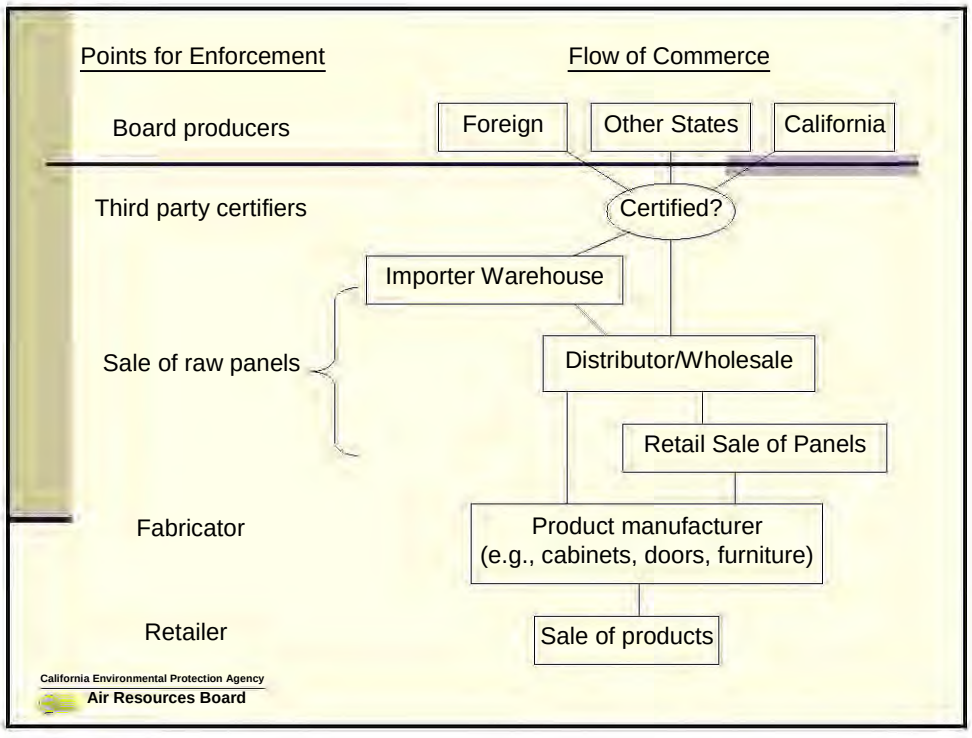

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Composite Wood ATCM Enforcement

Inspection Approach

- Chain of Custody documentation audit
- Review of third party certification emissions data
- Raw panel sampling and testing at ARB's certified small chamber under ASTM 6007
- Use finished product screening method (under development)
  - As a screening device
  - To test components of finished products
- If warranted, ARB enforcement investigation

Composite Wood ATCM Enforcement

Other Inspection Approaches

- Enforcement under ARB's program on ports
- Joint enforcement activities with USEPA, US Customs and local air pollution control districts
- Follow up on complaint hotline

Future Work on Enforcement Program

- Fully define third party certification requirements
- Continue dialogue with international producers/fabricators
- Further evaluate options to strengthen Chain of Custody
- Continue development of finished product screening method

Update on Emissions Inventory

ATCM Emission Inventory Update

- Health & Safety Code section 39665(a)(1) requires ARB to assess emissions of Toxic Air Contaminants
- On Aug. 4, 2004 staff last presented an estimate of the emission inventory associated with MDF, HWPW and PB
  - Estimated at 90 tons per year
  - Considered comments by the Composite Panel Association
  - Simple calculation based on fixed emission rate and annual production
  - Did not account for decay and multi-year emissions
- ARB staff is now refining the emissions inventory calculation for 2002 to account for:
  - Emissions decay, annual CA demand, lamination of boards

2002 California Emission Inventory
Methodology

$$ES_{2002} = \sum_{i=1992}^{2002} cE_i A_i$$

ES_{2002} = Statewide emission inventory, tons

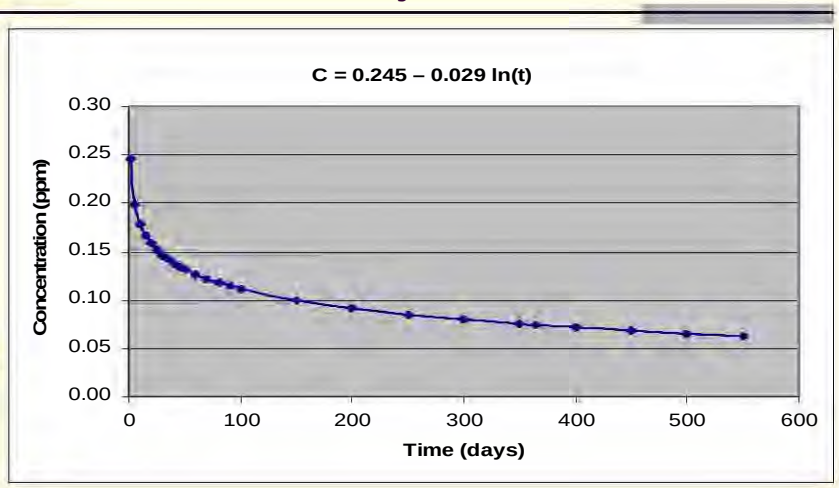
E_i = Annual emission rate of each product, grams/m^2

A_i = Area of each product associated with annual demand, m^2

c = Conversion factor from grams to tons

Calculation spans 1992 to 2002 to account for emissions decay

Particleboard Formaldehyde Concentration Decay Curve



Zinn, et al., 1990. Long-term study of formaldehyde emission decay from particleboard. *Forest Prod J.* 40(6):15-18.

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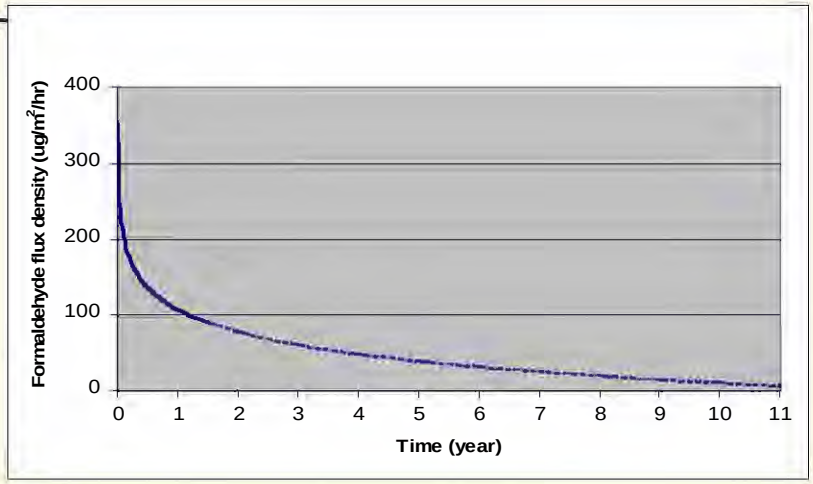
Particleboard Emission Flux Density*



* ARB Calculation

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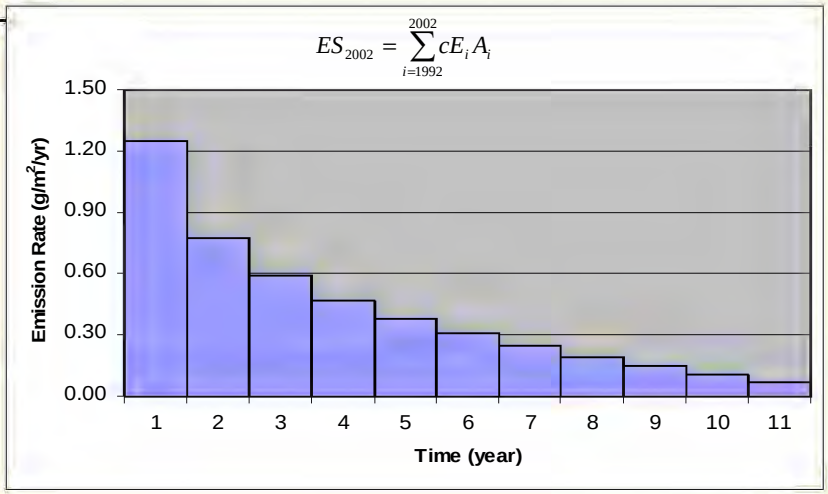
Particleboard Annual Emission Rate Over 11 Year Span

$$ES_{2002} = \sum_{i=1992}^{2002} cE_i A_i$$



2002 Raw Particleboard Emission Estimate

$$ES_{2002} = \sum_{i=1992}^{2002} cE_i A_i$$

Year	California Consumption (m^2)	Annual Emission rate in 2002 (g/m^2)	2002 Emissions (ton)	Cumulated 2002 Emissions (ton)	Percentage Contribution to 2002 Emission (%)	Cumulated Percentage Contribution to 2002 Emission (%)
1992	44,467,823	0.07	6.86	6.86	1.22	1.22
1993	48,681,082	0.11	11.81	18.67	2.10	3.32
1994	53,019,919	0.15	17.54	36.21	3.12	6.43
1995	49,143,820	0.19	20.59	56.80	3.66	10.09
1996	52,690,268	0.24	27.88	84.68	4.96	15.05
1997	54,269,203	0.31	37.10	121.78	6.59	21.64
1998	56,933,565	0.38	47.70	169.48	8.48	30.12
1999	57,809,217	0.47	59.91	229.39	10.65	40.76
2000	59,960,609	0.59	78.01	307.40	13.86	54.63
2001	55,737,696	0.78	95.86	403.26	17.04	71.66
2002	57,855,941	1.25	159.47	562.73	28.34	100.00

Particleboard Emissions Adjusted for Lamination Effects

PB Emissions = PB_{Raw} x AF_{Lam}

PB_{Raw} = Raw particleboard emissions
AF_{Lam} = Adjustment factor for laminated boards

- No studies showing long term decay curve of laminated particleboards
- Raw particleboard emissions (563 tons/year) adjusted to account for lamination
- Staff assumed percent of particleboard that is laminated
  - Range between 50% to 85%; midpoint 68%
- PB Emissions = 563 tpy x (1-.68) = **180** tons per year

Total Statewide Emissions

$$ES_{2002} = \sum_{i=1992}^{2002} cE_i A_i$$

- Will be sum of particleboard, hardwood plywood and medium density fiberboard emissions
- Medium density fiberboard and hardwood plywood have different decay models as compared to particleboard
- Staff currently developing estimates of statewide emissions of medium density fiberboard and hardwood plywood emissions for staff report

Additional Data Needs

- Volume of laminated particleboard and medium density fiberboard
- Flux density of hardwood plywood
- Flux density of medium density fiberboard

Update on Economic Impact

ATCM Cost Impacts

- Staff presented preliminary cost analysis on June 20th workshop
- Currently refining incremental board production cost analysis
- Refined new home cost analysis
- CWIC economic analysis

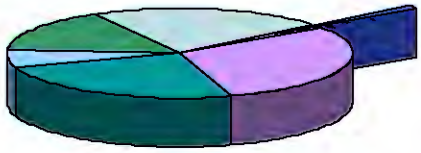
Commercially Available Resin Systems

Tradename	Company	Wood Products	Resin System
EcoBind Resin System	Hexion	HWPW, PB, MDF	MUF + co-reactants, PF, Soy/PVA blend
Kenocatch Catcher System	Akzo Nobel	MDF, PB	MUF + catcher
Rubinate & Suprasec Resin System	Huntsman	PB, MDF	Polyurethane & MDI
ReacTite EP-925	Franklin Chemical	HWPW	PVA
Multibond	States Industries	HWPW	PVA

- Additional research shows that minimal production equipment upgrades necessary for most Phase 2 resin systems

Cost Structure for Average House

National Average Home Price: $252,000



- **Composite wood ~0.4%***
- All Material ~30%
- Finished Lot/Financing - 25%
- Sales/Marketing - 6%
- Profit - 16%
- Labor - 22%

Source: Professional Builder and NAHB, March 2003

*ARB Staff Analysis, Oct 2006

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Estimate of Composite Wood Cost for a House

National Average House Price $252,000 *

	Board Thickness and sq. ft. Used **				Price ($) ***
	1/4 "	1/2 "	5/8 "	3/4 "	
PB	---	---	64.50	580.09	$438.90
MDF	273.44	72.0	---	---	$160.01
HWPW	194.32	---	74.50	252.93	$414.90

Total Composite Material Cost : $1013.81

$1013.81/$252,000= 0.4 %

Source: * National Association Home Builders
** Pricing: *Ganahl Lumber*, Lake Forest, CA
*** Material: Designer Custom Cabinets, Mission Viejo, CA

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Pre - and *Post*-ATCM Cost Increase

Case 1: PB and MDF board cost increases by 30%

HWPW board cost increases by 15%

	Pre-ATCM	Incremental Cost	*Post*-ATCM
PB	$ 438.90	+ $ 131.67	$ 570.57
MDF	$ 160.01	+ $ 48.00	$ 208.01
HWPW	$ 414.90	+ $ 62.24	$ 477.14
Total Cost	**$ 1013.18**	+ $ 241.91	**$ 1255.75**

Assumptions to further define cost sensitivity-

Case 2: All composite wood price increases by 30%

Case 3: All Composite wood price increases by 50%

ATCM Sensitivity Cost Analysis of a New House

	Home Price	Home Price % Increase
***Pre*-ATCM New Home Price (Composite Wood Material Cost)**	**$ 252,000** ($1,013.18)	**N/A**
***Post*-ATCM New Home Price Case 1** PB and MDF cost increase by 30% HWPW cost incases by 15%	**$ 252,241** (+ $241.91)	**0.096 %**
***Post*-ATCM New Home Price Case 2** - All Composite Wood Material Cost Increase by **30%**	**$ 252,304** (+ $304.14)	**0.12 %**
***Post*-ATCM New Home Price Case 3** - All Composite Wood Material Cost Increase by **50%**	**$ 252,507** (+ $506.90)	**0.20 %**

CWIC Economic Analysis

- Analysis shows $154 million to $1.04 billion cost to state
  - PB and MDF only
- Potential decline in final demand
  - Decline in final demand from 0% to 40%
  - Decrease in local manufacturing and related sales activity
  - Layoffs and business closures
- Increase in market prices to consumers
  - Cost data provided by resin suppliers and PB/MDF producers
  - Cost data reflect conditions under Phase 2
  - 100% of the cost increases are passed onto the consumer

Next Steps

- Individual meetings (international/domestic)
- Finished product screening method workgroup
- Continue development of enforcement provisions
- Publish staff report – December 8, 2006

ADJOURN

THANK YOU FOR YOUR PARTICIPATION!

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