Composite Wood Product ATCM -- Modeling Scenario No. 1:
HCHO Emissions from Composite Wood Products Stored at a Warehouse Store

Scenario Assumptions

- A suite of composite wood products, raw panels and case goods, is always on stock
- The amounts listed below are representative of what could be found at a large home repair store
- Estimates of "effective emission surface area" were made, consistent with a presentation made at workshop hosted by the Composite Products Association (CPA)
- In a worst-case scenario, total HCHO emissions from urea-HCHO products were estimated and the emissions were assumed to be released through a large roll-up door

⅜", ½', ⅝" and ¾" Particleboard or Medium Density Fiberboard (MDF)

- Shipped in 64 ft^3 bundles (2' x 4' x 8') -- ~32 to 64 boards/bundle
- Dimensions: Raw board length = 8', width = 4', bundle height = 2'
- Particleboard surface emission rate = 189 µg/m^2-hr (Battelle, 1996)
- Correction Factor: Edge emission rate = [3 x (Surface emission rate)] (Anonymous, 2002)
- Area-basis for (top + bottom) board-surface emissions = [(4' x 8') x 2] = 64-ft^2
- Area-basis for bundle edge emissions = [(2' x 8') + (2' x 4')] x 2 = 48-ft^2
- Adjusted area-basis for bundle edge emissions = [3 x 48-ft^2] = 144-ft^2
- Total effective emission surface area per bundle: (64 +144) = 208-ft^2
- Metric conversion factor: [ft^2 x 0.0929] = m^2
- HCHO emissions per bundle: [208-ft^2 x 0.0929 m^2/ft^2 x 189 µg/m^2-hr] = 3,652 µg/hr

2" Interior Door Core made with Particleboard

- Dimensions: Door core length = 36", width = 2"
- Interior Door Core surface emission rate = 7 µg/m^2-hr (Battelle, 1996)
- Area conversion factor: 144-in^2 = 1-ft^2
- Area-basis for (front + back) door core surface emissions = [(36" x 2") x 2] = 144-in^2 = 1-ft^2
- Metric conversion factor: [ft^2 x 0.0929] = m^2
- HCHO emissions per Door Core = (1-ft^2 x 0.0929 m^2/ft^2 x 7 µg/m^2-hr] = 0.65 µg/hr

½" MDF Baseboard, Crown Molding, and Chair Rail

- Shipped in 2.5 ft^3 bundles (0.42' x 20' x 2') -- ~48 units/bundle
- Dimensions: Unit length = 20', width = 5", bundle height = 2'
- MDF surface emission rate = 189 µg/m^2-hr (Battelle, 1996)
- Correction Factor: Edge emission rate = [3 x (Surface emission rate)] (Anonymous, 2002)
- Area-basis for (top + bottom) board-surface emissions = [(0.42' x 20') x 2] = 17-ft^2
- Area-basis for bundle edge emissions = [(2' x 20') + (2' x 0.42')] x 2 = 82-ft^2
- Adjusted area-basis for bundle edge emissions = [3 x 82-ft^2] = 246-ft^2
- Total effective emission surface area per bundle: (17 +246) = 263-ft^2
- Metric conversion factor: [ft^2 x 0.0929] = m^2
- HCHO emissions per bundle: [263 ft^2 x 0.0929 m^2/ft^2 x 189 µg/m^2-hr] = 4,617 µg/hr

¾" Melamine-covered Particleboard

- Shipped in 64 ft^3 bundles (2' x 4' x 8') -- ~32 boards/bundle
- Dimensions: Raw board length = 8', width = 4', bundle height = 2'
- Melamine-covered particleboard surface emission rate = 21 µg/m^2-hr (Battelle, 1996)
- Correction Factor: Edge emission rate = [3 x (Surface emission rate)] (Anonymous, 2002)
- Area-basis for (top + bottom) board-surface emissions = [(4' x 8') x 2] = 64-ft^2
- Area-basis for bundle edge emissions = [(2' x 8') + (2' x 4')] x 2 = 48-ft^2
- Adjusted area-basis for bundle edge emissions = [3 x 48-ft^2] = 144-ft^2
- Total effective emission surface area per bundle: (64 +144) = 208-ft^2
- Metric conversion factor: [ft^2 x 0.0929] = m^2
- HCHO emissions per bundle: [208-ft^2 x 0.0929 m^2/ft^2 x 21 µg/m^2-hr] = 406 µg/hr

⅜" and ¾" Hardwood Plywood

- Shipped in 64 ft^3 bundles (2' x 4' x 8') -- ~32 or 64 boards/bundle
- Dimensions: Raw board length = 8', width = 4', bundle height = 2'
- Hardwood plywood surface emission rate = 58 µg/m^2-hr (Battelle, 1996)
- Correction Factor: Edge emission rate = [3 x (Surface emission rate)] (Anonymous, 2002)

- Area-basis for (top + bottom) board-surface emissions = [(4’ x 8’) x 2] = 64-ft^2
- Area-basis for bundle edge emissions = [(2’ x 8’) + (2’ x 4’)] x 2 = 48-ft^2
- Adjusted area-basis for bundle edge emissions = [3 x 48-ft^2] = 144-ft^2
- Total effective emission surface area per bundle: (64 +144) = 208-ft^2
- Metric conversion factor: [ft^2 x 0.0929] = m^2
- HCHO emissions per bundle: [208-ft^2 x 0.0929 m^2/ft^2 x 58 µg/m^2-hr] = 1,121 µg/hr

¾” Particleboard Counter-tops

- Have one laminated side and other side is unfinished – emissions are generated from one-side only
- Stored in display case with spacers, allowing for HCHO emissions to be released from the unfinished side – there are about 50 counter-tops on display at a given time
- Particleboard surface emission rate = 189 µg/m^2-hr (Battelle, 1996)
- Dimensions: Length = 10’, width = 2½’
- Area basis for unfinished surface emissions = (10’ x 2½’) = 25-ft^2
- Total effective emission surface area for PB counter-tops = (25-ft^2/board x 50-boards) = 1,250-ft^2
- Metric conversion factor: [ft^2 x 0.0929] = m^2
- HCHO emissions from PB counter-tops = (1,250-ft^2 x 0.0929 m^2/ft^2 x 189 µg/m^2-hr] = 21,947 µg/hr

Cabinet Case Goods

- A within store “area” source – the portion of store where all case goods (e.g., cabinets, cabinet fronts, wall units, shelving, etc.) are displayed
- Dimensions of display area: 100’ long x 4’ wide x 10’ height = 4,000 ft^3
- Melamine-covered particleboard surface emission rate = 21 µg/m^2-hr (Battelle, 1996)
- Area of emitting surfaces: {2 x [(4’ x 10’) + (10’ x 100’)] + (4’ x 100’)} = {[2 x (80 + 1,000)] + 400} = 2,480 ft^2
- HCHO emissions from display area = (2,480-ft^2 x 0.0929 m^2/ft^2 x 21 µg/m^2-hr] = 4,838 µg/hr

References

- Battelle. 1996. Determination of Formaldehyde and Toluene Diisocyanate Emissions from Indoor Residential Sources. Final Report, No. 93-315, Air Resources Board, Research Division, Sacramento, CA. 119 pp.

- Anonymous. 2002. UF Composites – Contribution to California Ambient Inventory. Presentation to the Air Resources Board at the Composite Panel Association Informational Meeting on 24 January 2002. Power Point Presentation, 21-slides.

Inventory of HCHO Emissions from Composite Wood Products Stored at a Warehouse Store: Modeling Scenario[1]				
[2]Type of Composite Wood Product	[3]Amount	[4]Surface Area (m^2)	[5]Emission Factor ($\mu g/m^2$-hr)	Emission Rate (µg/hr)
A. Particleboard (PB)				
¾" Panels (4' x 8')	3-bundles	58	189	10,956
⅝" Panels (4' x 8')	2-bundles	39	189	7,304
½" Panels (4' x 8')	2-bundles	39	189	7,304
⅜" Panels (4' x 8')	2-bundles	39	189	7,304
2" Interior Door Cores (2" x 36")	200-doors	19	7	130
¾" Melamine-covered Panels (4' x 8')	3-bundles	58	21	1,217
¾" Counter-tops (2½' x 10')	50-counter-tops	116	189	21,947
B. Medium Density Fiberboard (MDF)				
¾" Panels (4' x 8')	3-bundles	58	189	10,956
⅝" Panels (4' x 8')	2-bundles	39	189	7,304
½" Baseboard (5" x 240")	5-bundles	122	189	23,089
½" Crown Molding (5" x 240")	4-bundles	98	189	18,471
½" Chair Rail (5" x 240")	3-bundles	73	189	13,853
C. Hardwood Plywood (HWPW)				
¾" Panels (4' x 8')	3-bundles	58	58	3,362
⅜" Panels (4' x 8')	1-bundle	19	58	1,121
D. Cabinet Case Goods				
Display area with shelving, cabinets, etc.	Occupies 4,000 ft^3	230	21	4,838
Total				139,159

[1] Based on a walk-through survey at a Home Depot store. [2] Includes panels and case goods made with PB, MDF, and/or HWPW bonded with urea-formaldehyde resins. [3] Panel bundles are 2-ft high; depending on panel thickness, there are 32 to 64 panels per bundle. Emissions from cabinet case goods are based on a (100' x 10' x 4') display space. [4] Area factor: [ft^2 x 0.0929 = m^2]. [5] From: Battelle (1996).