10.6.2 Particleboard Manufacturing

10.6.2.1 General[1,2] -

Particleboard is defined as a panel product manufactured from lignocellulosic materials, primarily in the form of discrete particles, combined with a synthetic resin or other suitable binder and bonded together under heat and pressure. The primary difference between particleboard and other reconstituted wood products, such as waferboard, oriented strandboard, medium density fiberboard, and hardboard, is the material or particles used in its production. The major types of particles used to manufacture particleboard include wood shavings, flakes, wafers, chips, sawdust, strands, slivers, and wood wool. The term particleboard sometimes is used generically to include waferboard and oriented strandboard, which are manufactured primarily with wood flakes and wafers. However, for the purposes of this report, particleboard pertains only to panels manufactured from a mixture of wood particles or otherwise from wood particles other than wafers and flakes. Particleboard manufacturing falls under Standard Industrial Classification (SIC) Code 2493, reconstituted wood products, which includes hardboard, insulation board, medium density fiberboard, waferboard and oriented strandboard in addition to particleboard. The six-digit Source Classification Code (SCC) for particleboard manufacturing is 3-07-006.

10.6.2.2 Process Description[1,2] -

Particleboard is produced in densities ranging from around 590 kilograms per cubic meter (kg/m^3) (37 pounds per cubic foot [lb/ft^3]) to greater than 800 kg/m^3 (50 lb/ft^3). Most particleboard is formed into panels. However, molded particleboard products such as furniture parts, door skins, or molded pallets are also produced.

Although some single-layer particleboard is produced, particleboard generally is manufactured in three or five layers. The outer layers are referred to as the surface or face layers, and the inner layers are termed the core layers. Face material generally is finer than core material. By altering the relative properties of the face and core layers, the bending strength and stiffness of the board can be increased.

The general steps used to produce particleboard include raw material procurement or generation, classifying by size, drying, blending with resin and sometimes wax, forming the resinated material into a mat, hot pressing, and finishing. Figure 10.6.2-1 presents a process flow diagram for a typical particleboard plant.

The furnish or raw material for particleboard normally consists of wood particles, primarily wood chips, sawdust, and planer shavings. This material may be shipped to the facility or generated onsite and stored until needed. In mills where chips are generated onsite, logs are debarked, sawn to proper length, and chipped. After shipping to the site or generation onsite, the furnish may be further reduced in size by means of hammermills, flakers, or refiners. After milling, the material is either screened using vibrating or gyratory screens, or the particles are air-classified. The purpose of this step is to remove the fines and to separate the core material from the surface material. The screened or classified material then is transported to storage bins.

From the storage bins, the core and surface material are conveyed to dryers. Rotary dryers are the most commonly used dryer type in the particleboard industry. Both single and triple-pass dryers are used. In addition, some facilities use tube dryers to dry the furnish. Wood-fired dryers are used at most facilities. However, gas- and oil-fired dryers also are used. The moisture content of the particles entering the dryers may be as high as 50 percent on a wet basis. Drying reduces the moisture content to 2 to 8 percent. Dryer inlet temperatures may be as high as 871°C (1600°F) if the furnish is wet; for dry furnish, inlet temperatures generally are no higher than 260°C (500°F). Dryers with an inlet furnish

moisture content of greater than 50 percent on a dry basis are labeled “green” dryers. A predryer may be used for initial drying of relatively wet furnish. Following predrying, the drying process is completed in a final dryer (which may be either a rotary dryer or a tube dryer). The dryer inlet temperature is adjusted based on the desired furnish moisture content at the dryer outlet. Core dryers generally operate at higher temperatures than surface dryers due to differences in core and surface particle characteristics and because a lower moisture content is more desirable for core material.

After drying, the particles pass through a primary cyclone for product recovery and then are transferred to holding bins. Face material sometimes is screened to remove the fines, which tend to absorb too much of the resin, prior to storage in the holding bins. From the holding bins, the core and surface materials are transferred to blenders, in which the particles are mixed with resin, wax, and other additives by means of spray nozzles, tubes, or atomizers. Urea-formaldehyde is the resin most commonly used for particleboard manufacture. However, phenol-formaldehyde resin may be used for particleboard produced for exterior applications.

Waxes are added to impart water resistance, increase the stability of the finished product under wet conditions, and to reduce the tendency for equipment plugging. For furnishes that are low in acidity, catalysts also may be blended with the particles to accelerate the resin cure and to reduce the press time. Formaldehyde scavengers also may be added in the blending step to reduce formaldehyde emissions from the process.

Blenders generally are designed to discharge the resinated particles into a plenum over a belt conveyor that feeds the blended material to the forming machine, which deposits the resinated material in the form of a continuous mat. Formers use air to convey the material, which is dropped or thrown into an air chamber above a moving caul, belt, or screen and floats down into position. To produce multilayer particleboard, several forming heads can be used in series, or air currents can produce a gradation of particle sizes from face to core. As it leaves the former, the mat may be prepressed prior to trimming and pressing. The mats then are cut into desired lengths and conveyed to the press. The press applies heat and pressure to activate the resin and bond the fibers into a solid panel. Although some single-opening presses are used, most domestic particleboard plants are equipped with multi-opening batch presses. Total press time is generally 2.5 minutes (min) for single-opening presses and up to 6 min for multi-opening presses. Continuous presses may also be used to produce particleboard. Presses generally are heated using steam generated by an onsite boiler that burns wood residue. However, hot oil and hot water also are used to heat the press. The operating temperature for particleboard presses generally ranges from 149° to 182°C (300° to 360°F).

The presses used to manufacture molded particleboard products are not platen presses, but are press molds equipped with a heated die that shapes the resinated wood particles into the finished product. Press temperatures can range from 132° to 288°C (270° to 550°F). Press temperature and time vary according to the molded product being produced.

After pressing, the boards generally are cooled prior to stacking. The particleboard panels then are sanded and trimmed to final dimensions, any other finishing operations (including laminate or veneer application) are done, and the finished product is packaged for shipment.

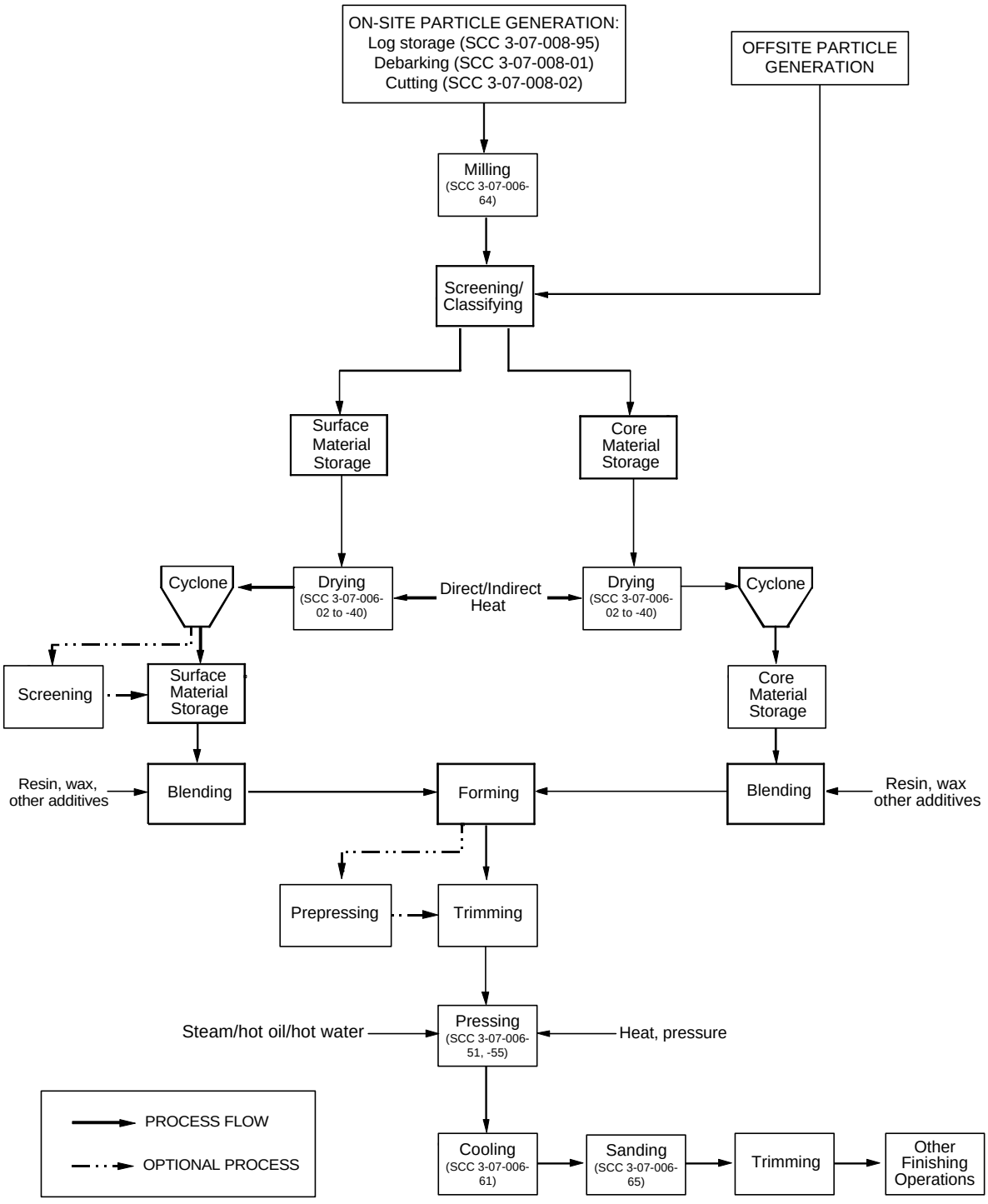

Figure 10.6.2-1. Process flow diagram for particleboard manufacturing.

10.6.2.3 Emissions And Controls[1-35] -

The primary emission sources at particleboard mills are particle dryers and hot press vents. Other emission sources may include boilers, particle generation, blending, forming, board cooling, and finishing operations such as sanding, trimming, and laminate or veneer application. Other potential emissions sources ancillary to the manufacturing process may include wood chip storage piles and bins (including wood fuel), chip handling systems, and resin storage and handling systems.

Although most particleboard mills have chips delivered from offsite locations, in mills where chips are generated onsite, operations such as log debarking and sawing, in addition to particle mills, screens, and classifiers generate particulate matter (PM) and PM less than 10 micrometers in aerodynamic diameter (PM-10) emissions in the form of sawdust and wood particles. In addition, these processes may be sources of PM less than 2.5 micrometers in aerodynamic diameter (PM-2.5) emissions.

Emissions from dryers that are exhausted from the primary recovery cyclone include wood dust and other solid PM, volatile organic compounds (VOCs), condensible PM, and products of combustion such as carbon monoxide (CO), carbon dioxide (CO_2), and nitrogen oxides (NO_x), if direct-fired units are used. The condensible PM and a portion of the VOCs leave the dryer stack as vapor but condense at normal atmospheric temperatures to form liquid particles or mist that creates a visible blue haze. Both the VOCs and condensible PM are primarily compounds evaporated from the wood, with a minor constituent being combustion products. Quantities emitted are dependent on wood species, dryer temperature, fuel used, and other factors including season of the year, time between logging and processing, and chip storage time.

Emissions from board hot presses are dependent on the type and amount of resin used to bind the wood fibers together, as well as wood species, wood moisture content, wax and catalyst application rates, and press conditions. When the press opens, vapors that may include resin ingredients such as formaldehyde and other VOCs are released. The rate at which formaldehyde is emitted during pressing and board cooling operations is a function of the amount of excess formaldehyde in the resin, board thickness, press temperature, press cycle time, and catalyst application rates.

Emissions from finishing operations for particleboard are dependent on the type of products being finished. For most particleboard products, finishing involves trimming to size and sanding. Some products may require application of laminate surfaces or veneers with adhesives. Trimming and sanding operations are sources of PM and PM-10 emissions. In addition, these processes may be sources of PM less than 2.5 micrometers in aerodynamic diameter (PM-2.5) emissions. No data specific to particleboard trimming and sawing are available. However, emissions factors for plywood or medium density fiberboard (MDF) sawing operations may provide an order of magnitude estimate for similar particleboard sawing and trimming operations.

In particleboard mills where particles are generated onsite, PM, PM-10, and PM-2.5 emissions from log debarking, sawing, and grinding operations can be controlled through capture in an exhaust system connected to a sized cyclone and/or fabric filter collection system. Emissions of PM, PM-10, and PM-2.5 from sanding and final trimming operations can be controlled using similar methods. These wood dust capture and collection systems are used not only to control atmospheric emissions, but also to recover the dust as a by-product fuel for a boiler or dryer.

Methods of controlling PM emissions from the particleboard sources include multiclones, absorption systems (wet scrubbers), fabric filters, sand filter scrubbers, electrified filter beds (EFBs), wet electrostatic precipitators (WESPs), and oxidation systems (discussed below). The sand filter scrubber incorporates a wet scrubbing section followed by a wet-sand filter and mist eliminator. The EFB uses

electrostatic forces to attract pollutants to an electrically charged gravel bed. The WESP uses electrostatic forces to attract pollutants to either a charged metal plate or a charged metal tube. The collecting surfaces are continually rinsed with water to wash away the pollutants. Wet PM control systems such as wet scrubbers and WESP's may achieve short-term reductions in emissions of some water-soluble organic compounds (such as formaldehyde). However, the ability of these wet systems to absorb water-soluble compounds diminishes as the recirculating scrubbing liquid becomes saturated with these compounds.

A VOC control technology commonly used in the wood products industry for controlling both dryer and press exhaust gases is regenerative thermal oxidation. Thermal oxidizers destroy VOCs and condensible organics by burning them at high temperatures. Thermal oxidizers also reduce CO emissions in direct-fired dryer exhausts by oxidizing the CO in the exhaust to CO_2 (a product of complete combustion). Regenerative thermal oxidizers (RTOs) are designed to preheat the inlet emission stream with heat recovered from the incineration exhaust gases. Up to 98 percent heat recovery is possible, although 95 percent is typically specified. Gases entering an RTO are heated by passing through pre-heated beds packed with a ceramic media. A gas burner brings the preheated emissions up to an incineration temperature between 788° and 871°C (1450° and 1600°F) in a combustion chamber with sufficient gas residence time to complete the combustion. Combustion gases then pass through a cooled ceramic bed where heat is extracted. By reversing the flow through the beds, the heat transferred from the combustion exhaust air preheats the gases to be treated, thereby reducing auxiliary fuel requirements.

Biofiltration systems are also used effectively for control of a variety of pollutants including organic compounds, NO_x, CO, and PM from press exhaust streams. Biofiltration uses microorganisms immobilized in a biofilm layer on a porous packing such as bark, wood chips, or synthetic media. Typical biofilter design consists of a three- to six-foot deep bed of media suspended over an air distribution plenum. Exhaust gases entering the plenum are evenly distributed through the moist biofilter media. As the contaminated vapor stream passes through the biofilter media, pollutants are transferred from the vapor to the biofilm and, through microbiological degradation, are converted to CO_2, water, and salts. The microorganisms cannot easily attack pollutants in the gas phase; therefore, less water soluble compounds (such as pinenes) are generally more difficult to control using a biofilter than are the more water-soluble compounds (such as formaldehyde).

Fugitive PM emissions from road dust and uncovered bark and dust storage piles may be controlled in a number of different ways. Some of these methods include enclosure, wet suppression systems, and chemical stabilization.

Calculating PM-10 emissions from wood products industry emission sources is problematic due to the relationship between PM-10 (or PM) emissions and VOC emissions from these processes. Because the Method 201A train (PM-10) operates with an in-stack cyclone and filter, organic materials that are volatile at stack gas temperatures but that are condensed at back half impinger temperatures (~20°C [~68°F]) are collected as condensible PM-10. However, these materials will also be measured as VOC via Methods 25 and 25A, which operate with a heated or an in-stack filter. Hence, if PM-10 is calculated as the sum of filterable and condensible material, some pollutants will be measured as both PM-10 and VOC emissions. However, if only filterable material is considered to be PM-10, the PM-10 emission factors will be highly dependent on stack gas temperature. In this AP-42 section, PM-10 is reported as front half catch only (Method 201A results only; not including Method 202 results). However, condensible PM results are also reported, and these results can be combined with the PM-10 results as appropriate for a specific application. Measured VOC emissions may be affected by the sampling method and by the quantity of formaldehyde and other aldehydes and ketones in the exhaust; formaldehyde is not quantified using Method 25A. Other low molecular weight oxygenated compounds

have reduced responses to Method 25A. Therefore, when VOC emissions are measured using Method 25A, the emission rates will be biased low if low molecular weight oxygenated compounds are present in significant concentrations in the exhaust stream. A more extensive discussion of these sampling and analysis issues is provided in the Background Report for this section.

Guidance from EPA's Emission Factor and Inventory Group (EFIG) indicates that when it is possible, VOC emission factors should be reported in terms of the actual weight of the emitted compound. However, when an actual molecular weight (MW) of the emitted stream is not feasible (as is the case with the mixed streams emitted from wood products industry sources), the VOC should be reported using an assumed MW of 44, and reported "as propane." Each VOC-as-propane emission factor is estimated by first converting the THC from a carbon basis to a propane basis. Propane (MW = 44) includes 3 carbon atoms (total MW of 36) and 8 hydrogen atoms (total MW of 8). Every 36 pounds of carbon measured corresponds to 44 pounds of propane. The ratio of the MW of propane to the MW of carbon in propane is 44/36, or 1.22. The conversion is expressed by the following equation:

$$\text{THC as pounds carbon} \times \frac{\text{44 pounds propane}}{\text{36 pounds carbon}} = \text{THC as pounds propane}$$

or

$$\text{THC as pounds carbon} \times 1.22 = \text{THC as pounds propane}$$

After the THC emission factor has been converted from a carbon to a propane basis, the formaldehyde emission factor is added (where available), then the available emission factors for non-VOC compounds, including acetone, methane, and methylene chloride, are subtracted. This procedure is expressed simply by the following equation:

$$\text{VOC as propane} = (1.22 \times \text{THC as carbon}) + \text{formaldehyde} - (\text{acetone} + \text{methane} + \text{methylene chloride})$$

In cases where no emission factor is available (or the emission factor is reported only as below the test method detection limit, or "BDL") for one or more of the compounds used to estimate the VOC-as-propane value, adjustments to the converted THC value are made only for those compounds for which emission factors are available. That is, a value of zero is inserted in the above equation for the specified compounds where no emission factor is available, or where the emission factor is reported only as BDL. For example, if no methane emission factor is available, the THC-as-carbon emission factor is converted to THC-as-propane, formaldehyde is added, and only acetone and methylene chloride are subtracted.

Table 10.6.2-1 presents emission factors for dryer emissions of PM, including filterable PM, filterable PM-10, and condensible PM. Table 10.6.2-2 presents emissions factors for dryer emissions of NO_x, CO, and CO_2. Table 10.6.2-3 presents emission factors for dryer emissions of organic compounds, some of which are listed as HAPs under section 112(b) of the Clean Air Act. The emission factors for dryer emissions are presented in units of pounds of pollutant per oven-dried ton of wood material out of the dryer (lb/ODT). Table 10.6.2-4 presents emission factors for press and board cooler emissions of PM, including filterable PM, filterable PM-10, and condensible PM. Table 10.6.2-5 presents emission factors for press and board cooler emissions of NO_x and CO. Table 10.6.2-6 presents emission factors for press and board cooler emissions of organic compounds, some of which are listed HAPs. The units for the press and board cooler emission factors are pounds of pollutant per thousand square feet of 3/4-inch thick panel produced (lb/MSF 3/4). Table 10.6.2-7 presents emission factors for miscellaneous sources of organic compounds. Some of the compounds also are listed HAPs.

To the extent possible, separate emission factors for particleboard dryers are presented in Tables 10.6.2-1 to -3 for hardwoods and softwoods. Hardwoods generally correspond to deciduous species. For particleboard, plywood, and other composite wood products, commonly used hardwoods

include aspen, oak, poplar, maple, cherry, alder, hickory, gum, beech, birch, and basswood. The emission factors for hardwood particleboard dryers presented in this section are based largely on the drying of aspen furnish. Oak also is used often for making particleboard. Softwoods generally correspond to coniferous species. For particleboard, plywood, and other composite wood products, commonly used softwoods include pines, firs, and spruce. Pines and firs are the most commonly used softwood species for particleboard manufacturing.

Emission factors for every possible mix of hardwood and softwood species cannot be reported in this section. Emission factors for specific mixes of wood species may be calculated by combining emission factors for individual wood species in the ratio specific to a given application, as emission data for those species become available. For example, a THC as carbon emission factor for a direct wood-fired rotary dryer processing 60 percent softwood and 40 percent hardwood may be calculated using the THC as carbon emission factors for softwood (1.0 lb/ODT) and hardwood (0.20 lb/ODT), and the ratio of 60 percent to 40 percent. The resultant emission factor, rounded to two significant figures, would be 0.68 lb/ODT.

Table 10.6.2-1. EMISSION FACTORS FOR PARTICLEBOARD DRYERS--PARTICULATE MATTER[a]

Source	Emission Control Device[c]	Filterable[b] PM	EMISSION FACTOR RATING	PM-10	EMISSION FACTOR RATING	Condensible[d]	EMISSION FACTOR RATING
Rotary dryer, direct wood-fired, hardwood (SCC 3-07-006-10)	Uncontrolled/ MCLO	3.3[e]	D	ND		0.21[e]	D
	SCBR	0.93[e]	D	ND		0.024[e]	D
	EFB	0.19[e]	D	ND		NA	
Rotary dryer, direct wood-fired, softwood (SCC 3-07-006-07)	Uncontrolled	3.4[e]	D	0.69[e]	D	0.20[e]	D
	MCLO	0.93[f]	D	ND		ND	
Rotary dryer, direct wood-fired, mixed species (35-60% softwood, 40-65% hardwood) (SCC 3-07-006-08)	Uncontrolled	2.2[g]	D	ND		0.48[g]	D
	EFB	0.28[h]	D	ND		NA	
Rotary dryer, green, direct wood-fired (inlet moisture content >50%, dry basis), softwood (SCC 3-07-006-25)	Uncontrolled/ MCLO	2.2[h]	D	ND		1.1[h]	D
	BH	1.4[h]	E	ND		NA	
	EFB	1.5[e]	E	0.64[e]	E	NA	
	EFB/BH	0.20[h]	E	ND		NA	
Rotary dryer, green, direct wood-fired (inlet moisture content >50%, dry basis), mixed species (40-60% softwood, 40-60% hardwood) (SCC 3-07-006-26)	Uncontrolled	ND		ND		0.62[k]	D
	MCLO	2.0[e]	E	ND		NA	
	BH	1.3[h]	E	ND		NA	
	EFB	0.27[e]	E	0.11[e]	D	NA	
	EFB/BH	0.15[j]	E	ND		NA	
Rotary dryer, direct natural gas-fired, hardwood (SCC 3-07-006-32)	Uncontrolled	ND				0.15[m]	D
	MCLO	2.2[e]	E	ND		NA	
	EFB	0.31[n]	E	ND		ND	
Rotary dryer, direct natural gas-fired, softwood (SCC 3-07-006-30)	Uncontrolled/ MCLO	0.42[p]	D	ND		0.12[q]	D

[a] Emission factor units are pounds of pollutant per oven-dried ton of wood material out of dryer (lb/ODT). One lb/ODT = 0.5 kg/Mg (oven-dried). Factors represent uncontrolled emissions unless otherwise noted. SCC = Source Classification Code. ND = no data available. NA = Not applicable. See Table 10.6.2-8 for the hardwood and softwood species commonly used in the production of particleboard and other composite wood products. **Note: emission factors in table represent averages of data sets. The data spreadsheets, which may be more useful for specific applications,**

Table 10.6.2-1 (cont.).

are available on EPA's Technology Transfer Network (TTN) website at: http://www.epa.gov/ttn/chief/.

[b] Filterable PM is that PM collected on or prior to the filter of an EPA Method 5 (or equivalent) sampling train. Filterable PM-10 is that PM collected on the filter, or in the sample line between the cyclone and filter of an EPA Method 201 or 201A sampling train.

[c] Emission control device: MCLO = multiclone; SCBR = wet scrubber; EFB = electrified filter bed; BH = baghouse (fabric filter).

[d] Condensible PM is that PM collected in the impinger portion of a PM sampling train (EPA Method 202); multiclones, EFB's, and baghouses are not expected to control condensible PM; condensible PM emissions measured at the outlets of those control devices are considered to be uncontrolled.

[e] Reference 7.

[f] References 8, 9, and 10.

[g] References 7, 11, 12, and 13.

[h] References 7 and 14.

[j] Reference 14.

[k] Reference 7, 11, and 14.

[m] Reference 7, 15, and 16.

[n] Reference 16.

[p] Reference 8, 17, and 18.

[q] Reference 17 and 18.

Table 10.6.2-2. EMISSION FACTORS FOR PARTICLEBOARD DRYERS--NO_x, CO, AND CO_2 [a]

Source[b]	Emission Control Device	NO_x	EMISSION FACTOR RATING	CO	EMISSION FACTOR RATING	CO_2	EMISSION FACTOR RATING
Rotary dryer, direct wood-fired, hardwood (SCC 3-07-006-10)	Uncontrolled	0.92[c]	D	5.7[c]	D	ND	
Rotary dryer, direct wood-fired, softwood (SCC 3-07-006-07)	Uncontrolled	0.58[d]	D	0.68[e]	C	ND	
Rotary dryer, direct wood-fired, mixed species (35-60% softwood, 40-65% hardwood) (SCC 3-07-006-08)	Uncontrolled	1.8[f]	D	0.59[c]	D	538[g]	D
Rotary dryer, green, direct wood-fired (inlet moisture content >50%, dry basis), softwood (SCC 3-07-006-25)	Uncontrolled	2.7[h]	D	3.5[h]	D	573[j]	D
Rotary dryer, green, direct wood-fired (inlet moisture content >50%, dry basis), mixed species (40-60% softwood, 40-60% hardwood) (SCC 3-07-006-26)	Uncontrolled	1.4[c]	E	0.77[k]	D	ND	
Rotary dryer, direct natural gas-fired, hardwood (SCC 3-07-006-32)	Uncontrolled	0.024[m]	E	1.2[m]	E	311[n]	E
Rotary dryer, green, direct natural gas-fired (inlet moisture content >50%, dry basis), softwood (SCC 3-07-006-31)	Uncontrolled	ND		ND		237[p]	D
Rotary dryer, indirect heated with auxiliary natural gas, softwood (SCC 3-07-006-35)	Uncontrolled	0.31[c]	D	0.12[c]	D	38.2[q]	D

Table 10.6.2-2 (cont.).

Source[b]	Emission Control Device	NO_x	EMISSION FACTOR RATING	CO	EMISSION FACTOR RATING	CO_2	EMISSION FACTOR RATING
Tube dryer, direct wood-fired, blowline blend, UF resin, hardwood (SCC 3-07-006-40)	Uncontrolled	ND		ND		447[r]	E

[a] Emission factor units are pounds of pollutant per oven-dried ton of wood material out of dryer (lb/ODT). One lb/ODT = 0.5 kg/Mg (oven-dried). Factors represent uncontrolled emissions unless otherwise noted. SCC = Source Classification Code. ND = no data available. See Table 10.6.2-8 for the hardwood and softwood species commonly used in the production of particleboard and other composite wood products. **Note: emission factors in table represent averages of data sets. The data spreadsheets, which may be more useful for specific applications, are available on EPA's Technology Transfer Network (TTN) website at: http://www.epa.gov/ttn/chief/.**

[b] UF = urea formaldehyde.

[c] Reference 7.

[d] References 7, 9, and 10.

[e] References 7, 9, 10, and 19.

[f] References 7, 12, and 13.

[g] References 11, 12, 13, and 14.

[h] References 7, 20, and 21.

[j] References 14, 20, and 21.

[k] References 7 and 19.

[m] Reference 15.

[n] Reference 22.

[p] References 21 and 23.

[q] Reference 24.

[r] Reference 25.

Table 10.6.2-3. EMISSION FACTORS FOR PARTICLEBOARD DRYERS--ORGANICS[a]

Source	Emission Control Device[b]	CASRN[c]	Pollutant	Emission Factor	EMISSION FACTOR RATING
Rotary dryer, direct wood-fired, hardwood (SCC 3-07-006-10)	Uncontrolled		THC as carbon[d]	0.20[f]	D
			VOC as propane[e]	0.24	E
Rotary dryer, direct wood-fired, softwood (SCC 3-07-006-07)	Uncontrolled		THC as carbon[d]	1.0[g]	C
			VOC as propane[e]	0.90	D
		71-55-6	1,1,1-Trichloroethane *	0.000012[f]	D
			1,2-Dichloroethane *	BDL	
			1,2,4-Trichlorobenzene *	BDL	
		95-63-6	1,2,4-Trimethyl benzene	0.000090[f]	D
		5779-94-2	2,5-Dimethyl benzaldehyde	0.000033[f,y]	E
		13466-78-9	3-Carene	0.076	D
		75-07-0	Acetaldehyde *	0.013	D
		67-64-1	Acetone	0.084[h]	D
		98-86-2	Acetophenone	0.000064[f]	D
		107-02-8	Acrolein *	0.0045	D
		80-56-8	Alpha-pinene	0.39	D
		100-52-7	Benzaldehyde	0.0026[f,y]	E
		71-43-2	Benzene *	0.00099[h]	D
		127-91-3	Beta-pinene	0.12	D
		92-52-4	Biphenyl *	0.000039[f]	D
		117-81-7	Bis-(2-ethylhexyl phthalate)	0.00032[f]	D
		74-83-9	Bromomethane *	0.000028[f]	D
		123-72-8	Butylaldehyde	0.0031[f,y]	E
		85-68-7	Butylbenzyl phthalate	0.000014[f]	E
			Camphene	BDL	
		75-15-0	Carbon disulfide *	0.000018[f]	D
		56-23-5	Carbon tetrachloride *	0.000012[f]	D
			Chloroethane *	BDL	
			Chloroethene *	BDL	
		74-87-3	Chloromethane *	0.00011[f]	D
			Cis-1,2-dichloroethylene	BDL	
		98-82-8	Cumene *	0.000069[f]	D
		84-74-2	Di-N-butyl phthalate	0.000023[f]	D
		75-18-3	Dimethyl sulfide	0.000014[f]	E
		74-84-0	Ethane	0.015[j]	D
		100-41-4	Ethyl benzene *	0.0000038[f]	E
		50-00-0	Formaldehyde *	0.025[k]	C
		66-25-1	Hexaldehyde	0.016[f,y]	E
		123-31-9	Hydroquinone	0.000060[f]	E
		590-86-3	Isovaleraldehyde	0.00052[f,y]	E
		138-86-3	Limonene	0.034	D
		1330-20-7	m-, p-Xylene *	0.00055[h]	D
		620-23-5	m-Tolualdehyde	0.00045[f,y]	E
		64-82-8	Methane	0.26[j]	D
		67-56-1	Methanol *	0.014[m]	D
		78-93-3	Methyl ethyl ketone *	0.0049[h]	D
		108-10-1	Methyl isobutyl ketone *	0.0024[h]	D
		75-09-2	Methylene chloride *	0.00063[h]	D
		110-54-3	n-Hexane*	0.000026[f]	E
		95-47-6	o-Xylene *	0.000014[f]	D

Table 10.6.2-3 (cont.).

Source	Emission Control Device[b]	CASRN[c]	Pollutant	Emission Factor	EMISSION FACTOR RATING
Rotary dryer, direct wood-fired, softwood (SCC 3-07-006-07) (cont.)			p-Cymene	BDL	
			p-Mentha-1,5-diene	BDL	
		108-95-2	Phenol *	0.0066	D
		123-38-6	Propionaldehyde *	0.0032	D
		100-42-5	Styrene *	0.00012[f]	E
		108-88-3	Toluene *	0.0021[h]	D
		110-62-3	Valeraldehyde	0.0016[f,y]	E
Rotary dryer, direct wood-fired, mixed species (35-60% softwood, 40-65% hardwood) (SCC 3-07-006-08)	Uncontrolled		THC as carbon[d]	0.048[f]	E
			VOC as propane[e]	0.059	E
Rotary dryer, green, direct wood-fired, softwood (inlet moisture content >50%, dry basis) (SCC 3-07-006-25)	Uncontrolled		THC as carbon[d]	3.9[n]	D
			VOC as propane[e]	4.7	E
			1,2-Dichloroethane *	BDL	
			1,2,4-Trichlorobenzene *	BDL	
		5779-94-2	2,5-Dimethyl benzaldehyde	0.0053[f,y]	E
		13466-78-9	3-Carene	0.043	E
		80-56-8	Alpha-pinene	1.4[h]	D
		8006-64-2	a-Terpene	0.17[f]	E
		75-07-0	Acetaldehyde *	0.075[h]	D
		67-64-1	Acetone	0.19[h]	D
		107-02-8	Acrolein *	0.023[f,y]	E
		127-91-3	Beta-pinene	0.52[h]	D
		100-52-7	Benzaldehyde	0.12[f,y]	E
		71-43-2	Benzene *	0.0076	D
			Bromomethane *	BDL	
		123-72-8	Butylaldehyde	0.029[f,y]	E
		79-92-5	Camphene	0.043	E
			Chloroethane *	BDL	
			Chloroethene *	BDL	
		67-66-3	Chloroform	0.00010[f]	E
			Cis-1,2-dichloroethylene	BDL	
		4170-30-3	Crotonaldehyde	0.010[f,y]	E
		98-82-8	Cumene *	0.0020[f]	E
		50-00-0	Formaldehyde *	0.14[p]	D
		66-25-1	Hexaldehyde	0.022[f,y]	E
		590-86-3	Isovaleraldehyde	0.018[f,y]	E
		138-86-3	Limonene	0.043	E
		67-56-1	Methanol *	0.11[q]	D
		78-93-3	Methyl ethyl ketone *	BDL	
		108-10-1	Methyl isobutyl ketone *	0.0069	D
		75-09-2	Methylene chloride *	0.0018[h]	D
		1330-20-7	m,p-Xylene *	0.0048[h]	D
		123-72-8	n-Butyraldehyde	0.030[f,y]	E
		529-20-4	o-Tolualdehyde	0.011[f,y]	E
		95-47-6	o-Xylene *	0.00045[f]	E
		99-87-6	p-Cymene	0.027[h]	D
		99-83-2	p-Mentha-1,5-diene	0.043	E

Table 10.6.2-3 (cont.).

Source	Emission Control Device[b]	CASRN[c]	Pollutant	Emission Factor	EMISSION FACTOR RATING
Rotary dryer, green, direct wood-fired, softwood (inlet moisture content >50%, dry basis) (SCC 3-07-006-25) (cont.)		104-87-0	p-Tolualdehyde	0.026[f,y]	E
		108-95-2	Phenol *	0.028	D
		123-38-6	Propionaldehyde *	0.013[h]	D
		100-42-5	Styrene *	0.00036[f]	E
		108-88-3	Toluene *	0.013[h]	D
		110-62-3	Valeraldehyde	0.014[f,y]	E
Rotary dryer, green, direct wood-fired, mixed species (40-60% softwood, 40-60% hardwood) (inlet moisture content >50%, dry basis) (SCC 3-07-006-26)	Uncontrolled		THC as carbon[d]	1.3[h]	D
			VOC as propane[e]	1.6	E
			1,2-Dichloroethane *	BDL	
			1,2,4-Trichlorobenzene *	BDL	
		5779-94-2	2,5-Dimethyl benzaldehyde	0.0015[f,y]	E
		13466-78-9	3-Carene	0.040	D
		80-56-8	Alpha-pinene	0.51[h]	D
		8006-64-2	a-Terpene	0.053[f]	E
		75-07-0	Acetaldehyde *	0.059[h]	D
		67-64-1	Acetone	0.047[h]	D
		107-02-8	Acrolein *	0.015	D
		127-91-3	Beta-pinene	0.11[h]	D
		100-52-7	Benzaldehyde	0.0082[f,y]	E
		71-43-2	Benzene *	0.0047	D
			Bromomethane *	BDL	
		123-72-8	Butylaldehyde	0.0019[f,y]	E
			Camphene	BDL	
			Chloroethane *	BDL	
			Chloroethene *	BDL	
		156-59-2	Cis-1,2-dichloroethylene	0.0012	D
		4170-30-3	Crotonaldehyde	0.00082[f,y]	E
			Cumene *	BDL	
		50-00-0	Formaldehyde *	0.096[h]	D
		66-25-1	Hexaldehyde	0.0062[f,y]	E
		590-86-3	Isovaleraldehyde	0.0011[f,y]	E
			Limonene	BDL	
		67-56-1	Methanol *	0.059	D
		78-93-3	Methyl ethyl ketone *	0.0034	D
			Methyl isobutyl ketone *	BDL	
		75-09-2	Methylene chloride *	0.0014[h]	D
		1330-20-7	m,p-Xylene *	0.0058	D
		529-20-4	o-Tolualdehyde	0.00066[f,y]	E
		95-47-6	o-Xylene *	0.00058	D
		99-87-6	p-Cymene	0.0016[f]	D
			p-Mentha-1,5-diene	BDL	
		104-87-0	p-Tolualdehyde	0.0046[f,y]	E
		108-95-2	Phenol *	0.0079	D
		123-38-6	Propionaldehyde *	0.0042[h]	D
		100-42-5	Styrene *	0.00057	D
		108-88-3	Toluene *	0.0059[h]	D
		110-62-3	Valeraldehyde	0.0040[f,y]	E

Table 10.6.2-3 (cont.).

Source	Emission Control Device[b]	CASRN[c]	Pollutant	Emission Factor	EMISSION FACTOR RATING
Rotary dryer, green, direct wood-fired, mixed species (40-60% softwood, 40-60% hardwood) (inlet moisture content >50%, dry basis) (SCC 3-07-006-26)	RTO		THC as carbon[d]	0.013	E
			VOC as propane[e]	0.013	E
			1,2-Dichloroethane *	BDL	
			1,2,4-Trichlorobenzene *	BDL	
			3-Carene	BDL	
			Acetaldehyde *	BDL	
		67-64-1	Acetone	0.0033	E
			Acrolein *	BDL	
			Alpha-pinene	BDL	
		71-43-2	Benzene *	0.00055	E
			Beta-pinene	BDL	
			Bromomethane *	BDL	
			Camphene	BDL	
			Chloroethane *	BDL	
			Chloroethene *	BDL	
			Cis-1,2-dichloroethylene	BDL	
			Cumene *	BDL	
		50-00-0	Formaldehyde *	0.00055	E
			Limonene	BDL	
		67-56-1	Methanol *	0.0019	E
			Methyl ethyl ketone *	BDL	
			Methyl isobutyl ketone *	BDL	
		75-09-2	Methylene chloride *	0.00060	E
		1330-20-7	m,p-Xylene *	0.00075	E
		95-47-6	o-Xylene *	0.00075	E
			p-Cymene	BDL	
			p-Mentha-1,5-diene	BDL	
			Phenol *	BDL	
			Propionaldehyde *	BDL	
		100-42-5	Styrene *	0.00074	E
		108-88-3	Toluene *	0.00065	E
Rotary dryer, direct natural gas-fired, hardwood (SCC 3-07-006-32)	Uncontrolled		THC as carbon[d]	0.21[r]	E
			VOC as propane[e]	0.28	E
		50-00-0	Formaldehyde *	0.028[s]	E
Rotary dryer, direct natural gas-fired, softwood (SCC 3-07-006-30)	Uncontrolled		THC as carbon[d]	1.6[t]	D
			VOC as propane[e]	2.0	E
		50-00-0	Formaldehyde *	0.0086[u]	E
		67-56-1	Methanol *	0.073[u]	E
Rotary dryer, green, direct natural gas-fired, softwood (inlet moisture content >50%, dry basis) (SCC 3-07-006-31)	Uncontrolled		THC as carbon[d]	0.77[v]	E
			VOC as propane[e]	0.94	E
		50-00-0	Formaldehyde *	0.0042[v]	E
		67-56-1	Methanol *	BDL	

Table 10.6.2-3 (cont.).

Source	Emission Control Device[b]	CASRN[c]	Pollutant	Emission Factor	EMISSION FACTOR RATING
Rotary dryer, indirect heated with auxiliary natural gas, softwood (SCC 3-07-006-35)	Uncontrolled		THC as carbon[d]	0.43[w]	D
			VOC as propane[e]	0.30	E
		50-00-0	Formaldehyde *	0.047[x]	D
		64-82-8	Methane	0.27[f]	D
		67-56-1	Methanol *	0.027[x]	D

[a] Emission factor units are pounds of pollutant per oven-dried ton of wood material out of dryer (lb/ODT). One lb/ODT = 0.5 kg/Mg (oven-dried). Factors represent uncontrolled emissions unless otherwise noted. SCC = Source Classification Code. * = hazardous air pollutant. BDL = below test method detection limit; indicates that this pollutant has not been detected in any test runs on this source. Reference 19 unless otherwise noted. See Table 10.6.2-8 for the hardwood and softwood species commonly used in the production of particleboard and other composite wood products. **Note: emission factors in table represent averages of data sets. The data spreadsheets, which may be more useful for specific applications, are available on EPA's Technology Transfer Network (TTN) website at: http://www.epa.gov/ttn/chief/.**

[b] Emission control device: RTO = regenerative thermal oxidizer.

[c] CASRN = Chemical Abstracts Service Registry Number.

[d] THC as carbon = total hydrocarbon measurements using EPA Method 25A.

[e] VOC as propane = (1.22 × THC) + formaldehyde - (acetone + methane + methylene chloride); a value of zero is inserted in the equation for the specified compounds where no emission factor is available, or where the emission factor is reported only as "BDL".

[f] Reference 7.

[g] References 7, 9, 10, and 19.

[h] References 7 and 19.

[j] References 9 and 10.

[k] References 7, 9, 19, and 26.

[m] References 9, 19, and 26.

[n] References 7, 19, 20, and 21.

[p] References 7, 19, 20, 21, and 27.

[q] References 19 and 21.

[r] Reference 15.

[s] Reference 22.

[t] References 17 and 18.

[u] Reference 17.

[v] Reference 23.

[w] References 7 and 24.

[x] Reference 24.

[y] Based on M0011 data only; suspected to be biased low due to poor collection efficiency or analytical problems.

Table 10.6.2-4. EMISSION FACTORS FOR PARTICLEBOARD PRESSES AND BOARD COOLERS--PARTICULATE MATTER[a]

Source[c]	Emission Control Device	Filterable[b]				Condensible[d]	EMISSION FACTOR RATING
		PM	EMISSION FACTOR RATING	PM-10	EMISSION FACTOR RATING		
Hot press, UF resin (SCC 3-07-006-51)	Uncontrolled	0.20[e]	D	0.016[f]	E	0.23[g]	D
Board cooler, UF resin (SCC 3-07-006-61)	Uncontrolled	0.15[g]	D	ND		0.077[g]	D

[a] Emission factor units are pounds of pollutant per thousand square feet of 3/4-inch thick panel (lb/MSF 3/4). One lb/MSF 3/4 = 0.26 kg/m^3. Factors represent uncontrolled emissions unless otherwise noted. SCC = Source Classification Code. ND = no data available. **Note: emission factors in table represent averages of data sets. The data spreadsheets, which may be more useful for specific applications, are available on EPA's Technology Transfer Network (TTN) website at: http://www.epa.gov/ttn/chief/.**

[b] Filterable PM is that PM collected on or prior to the filter of an EPA Method 5 (or equivalent) sampling train. Filterable PM-10 is that PM collected on the filter, or in the sample line between the cyclone and filter of an EPA Method 201 or 201A sampling train.

[c] UF = urea formaldehyde.

[d] Condensible PM is that PM collected in the impinger portion of a PM sampling train (EPA Method 202).

[e] References 7, 26, 28, and 29.

[f] Reference 7.

[g] References 28 and 29.

Table 10.6.2-5. EMISSION FACTORS FOR PARTICLEBOARD PRESSES AND BOARD COOLERS--NO_x, CO, AND CO_2 [a]

Source[b]	Emission Control Device[c]	NO_x	EMISSION FACTOR RATING	CO	EMISSION FACTOR RATING	CO_2	EMISSION FACTOR RATING
Hot press, UF resin (SCC 3-07-006-51)	Uncontrolled	0.017[d]	E	0.22[e]	D	ND	
	RTO	0.092[d]	E	0.090[f]	D	ND	
Board cooler, UF resin (SCC 3-07-006-61)	Uncontrolled	ND		0.15[g]	D	ND	

[a] Emission factor units are pounds of pollutant per thousand square feet of 3/4-inch thick panel (lb/MSF 3/4). One lb/MSF 3/4 = 0.26 kg/m^3. Factors represent uncontrolled emissions unless otherwise noted. SCC = Source Classification Code. ND = no data available. **Note: emission factors in table represent averages of data sets. The data spreadsheets, which may be more useful for specific applications, are available on EPA's Technology Transfer Network (TTN) website at: http://www.epa.gov/ttn/chief/.**

[b] UF = urea formaldehyde.

[c] Emission control device: RTO = regenerative thermal oxidizer.
[d] Reference 26.
[e] References 7, 15, 19, 26, 28, and 29.
[f] References 19 and 26.
[g] References 28 and 29.

Table 10.6.2-6. EMISSION FACTORS FOR PARTICLEBOARD PRESSES AND BOARD COOLERS--ORGANICS[a]

Source[b]	Emission Control Device[c]	CASRN[d]	Pollutant	Emission Factor	EMISSION FACTOR RATING
Hot press, UF resin (SCC 3-07-006-51)	Uncontrolled		THC as carbon[e]	0.79[g]	C
			VOC as propane[f]	1.1	D
			1,2-Dichloroethane *	BDL	
			1,2,4-Trichlorobenzene *	BDL	
		5779-94-2	2,5-Dimethyl benzaldehyde	0.00032[h,j]	E
		13466-78-9	3-Carene	0.036	D
		75-07-0	Acetaldehyde *	0.011[k]	D
		67-64-1	Acetone	0.029[m]	D
		107-02-8	Acrolein *	0.0054[m]	D
		80-56-8	Alpha-pinene	0.40	D
		100-52-7	Benzaldehyde	0.0018[j,n]	E
		71-43-2	Benzene *	0.0030	D
		127-91-3	Beta-pinene	0.11	D
			Bromomethane *	BDL	
		123-72-8	Butylaldehyde	0.0019[j,n]	E
		79-92-5	Camphene	0.044	D
			Chloroethane *	BDL	
			Chloroethene *	BDL	
			Cis-1,2-dichloroethylene	BDL	
		4170-30-3	Crotonaldehyde	0.00050[h,j]	E
			Cumene *	BDL	
		50-00-0	Formaldehyde *	0.23[p]	C
		66-25-1	Hexaldehyde	0.010[j,n]	E
		590-86-3	Isovaleraldehyde	0.0011[h,j]	E
		138-86-3	Limonene	0.036	D
		67-56-1	Methanol *	0.59[q]	D
		78-93-3	Methyl ethyl ketone *	0.0052[m]	D
		108-10-1	Methyl isobutyl ketone *	0.0099	D
			Methylene chloride *	BDL	
			m,p-Xylene *	BDL	
			o-Xylene *	BDL	
		99-87-6	p-Cymene	0.035	D
		99-83-2	p-Mentha-1,5-diene	0.036	D
		108-95-2	Phenol *	0.011	D
			Propionaldehyde *	BDL	
			Styrene *	BDL	
			Toluene *	BDL	
		110-62-3	Valeraldehyde	0.0039[h,j]	E

Table 10.6.2-6 (cont.).

Source[b]	Emission Control Device[c]	CASRN[d]	Pollutant	Emission Factor	EMISSION FACTOR RATING
Hot press, UF resin (SCC 3-07-006-51)	RTO		THC as carbon[e]	0.018	E
			VOC as propane[f]	0.027	E
			1,2-Dichloroethane *	BDL	
			1,2,4-Trichlorobenzene *	BDL	
			3-Carene	BDL	
			Acetaldehyde *	BDL	
			Acetone	BDL	
			Acrolein *	BDL	
			Alpha-pinene	BDL	
			Benzene *	BDL	
			Beta-pinene	BDL	
			Bromomethane *	BDL	
			Camphene	BDL	
			Chloroethane *	BDL	
			Chloroethene *	BDL	
			Cis-1,2-dichloroethylene	BDL	
			Cumene *	BDL	
		50-00-0	Formaldehyde *	0.0054[q]	D
			Limonene	BDL	
			Methanol *	BDL	
			Methyl ethyl ketone *	BDL	
			Methyl isobutyl ketone *	BDL	
			Methylene chloride *	BDL	
			m,p-Xylene *	BDL	
			o-Xylene *	BDL	
			p-Cymene	BDL	
			p-Mentha-1,5-diene	BDL	
		108-95-2	Phenol *	0.0082	E
			Propionaldehyde *	BDL	
			Styrene *	BDL	
			Toluene *	BDL	

Table 10.6.2-6 (cont.).

Source[b]	Emission Control Device[c]	CASRN[d]	Pollutant	Emission Factor	EMISSION FACTOR RATING
Board cooler, UF resin (SCC 3-07-006-61)	Uncontrolled		THC as carbon[e]	0.069[r]	D
			VOC as propane[f]	0.091	E
			1,2-Dichloroethane *	BDL	
			1,2,4-Trichlorobenzene *	BDL	
			3-Carene	BDL	
		75-07-0	Acetaldehyde *	0.0036[s]	D
		67-64-1	Acetone	0.0083[m]	D
		107-02-8	Acrolein *	0.00036[h,j]	E
		80-56-8	Alpha-pinene	0.050	D
		100-52-7	Benzaldehyde	0.00042[h,j]	E
			Benzene *	BDL	
			Beta-pinene	BDL	
			Bromomethane *	BDL	
		123-72-8	Butylaldehyde	0.00060[h,j]	E
			Camphene	BDL	
			Chloroethane *	BDL	
			Chloroethene *	BDL	
			Cis-1,2-dichloroethylene	BDL	
		4170-30-3	Crotonaldehyde	0.00029[h,j]	E
			Cumene *	BDL	
		50-00-0	Formaldehyde *	0.015[t]	D
		66-25-1	Hexaldehyde	0.0011[h,j]	E
		590-86-3	Isovaleraldehyde	0.00040[h,j]	E
			Limonene	BDL	
		67-56-1	Methanol *	0.081	D
		78-93-3	Methyl ethyl ketone *	0.00011[h,j]	E
		108-10-1	Methyl isobutyl ketone *	0.0032	E
			Methylene chloride *	BDL	
			m,p-Xylene *	BDL	
			o-Xylene *	BDL	
			p-Cymene	BDL	
			p-Mentha-1,5-diene	BDL	
		108-95-2	Phenol *	0.0066	D
			Propionaldehyde *	BDL	
			Styrene *	BDL	
			Toluene *	BDL	
		110-62-3	Valeraldehyde	0.0015[h,j]	E

[a] Emission factor units are pounds of pollutant per thousand square feet of 3/4-inch thick panel (lb/MSF 3/4). One lb/MSF 3/4 = 0.26 kg/m^3. Factors represent uncontrolled emissions unless otherwise noted. SCC = Source Classification Code. * = hazardous air pollutant. BDL = below test method detection limit; indicates that this pollutant has not been detected in any test runs on this source. Reference 19 unless otherwise noted. **Note: emission factors in table represent averages of data sets. The data spreadsheets, which may be more useful for specific applications, are**

Table 10.6.2-6 (cont.).

available on EPA's Technology Transfer Network (TTN) website at: http://www.epa.gov/ttn/chief/.

[b] UF = urea formaldehyde.

[c] Emission control device: RTO = regenerative thermal oxidizer.

[d] CASRN = Chemical Abstracts Service Registry Number.

[e] THC as carbon = total hydrocarbon measurements using EPA Method 25A.

[f] VOC as propane = (1.22 × THC) + formaldehyde - (acetone + methane + methylene chloride); a value of zero is inserted in the equation for the specified compounds where no emission factor is available, or where the emission factor is reported only as "BDL".

[g] References 7, 15, 19, 26, 28, 29, and 30.

[h] Reference 7.

[j] Based on M0011 data only; suspected to be biased low due to poor collection efficiency or analytical problems.

[k] References 7, 15, and 19.

[m] Reference 19.

[n] References 7 and 15.

[p] References 7, 15, 19, 26, 28, 29, 31, 32, 33, and 34.

[q] References 19 and 26.

[r] References 7, 28, 29, and 30.

[s] References 7 and 19.

[t] References 19, 28, and 29.

Table 10.6.2-7. EMISSION FACTORS FOR PARTICLEBOARD MISCELLANEOUS SOURCES[a]

Source	Emission Control Device[b]	CASRN[c]	Pollutant	Emission Factor	Emission Factor Units[d]	EMISSION FACTOR RATING
Log storage (SCC 3-07-008-95)	Uncontrolled		PM, THC, VOC	ND		
Log debarking (SCC 3-07-008-01)	Uncontrolled		PM, THC, VOC	ND		
Log cutting (SCC 3-07-008-02)	Uncontrolled		PM, THC, VOC	ND		
Flaker/ refiner/ hammermill, softwoods and mixtures containing softwoods (SCC 3-07-006-64)	Uncontrolled		THC as carbon[e]	0.94	lb/ODT	D
			VOC as propane[f]	1.1	lb/ODT	E
			1,2-Dichloroethane *	BDL		
			1,2,4-Trichlorobenzene *	BDL		
			3-Carene	BDL		
			Acetaldehyde *	BDL		
		67-64-1	Acetone	0.0064	lb/ODT	D
			Acrolein *	BDL		
		80-56-8	Alpha-pinene	0.49	lb/ODT	D
			Benzene *	BDL		
		127-91-3	Beta-pinene	0.15	lb/ODT	D
			Bromomethane *	BDL		
			Camphene	BDL		
			Chloroethane *	BDL		
			Chloroethene *	BDL		
			Cis-1,2-dichloroethylene	BDL		
			Cumene *	BDL		
			Formaldehyde *	BDL		
			Limonene	BDL		
		67-56-1	Methanol *	0.0073	lb/ODT	D
			Methyl ethyl ketone *	BDL		
			Methyl isobutyl ketone *	BDL		
			Methylene chloride *	BDL		
			m,p-Xylene *	BDL		
			o-Xylene *	BDL		
			p-Cymene	BDL		
			p-Mentha-1,5-diene	BDL		
		108-95-2	Phenol *	0.0045	lb/ODT	E
			Propionaldehyde *	BDL		
			Styrene *	BDL		
			Toluene *	BDL		

Table 10.6.2-7 (cont.).

Source	Emission Control Device[b]	CASRN[c]	Pollutant	Emission Factor	Emission Factor Units[d]	EMISSION FACTOR RATING
Sander (SCC 3-07-006-65)	Uncontrolled		THC as carbon[e]	0.069	lb/MSF	E
			VOC as propane[f]	0.079	lb/MSF	E
			1,2-Dichloroethane *	BDL		
			1,2,4-Trichlorobenzene *	BDL		
			3-Carene	BDL		
			Acetaldehyde *	BDL		
		67-64-1	Acetone	0.0051	lb/MSF	E
			Acrolein *	BDL		
		80-56-8	Alpha-pinene	0.048	lb/MSF	E
			Benzene *	BDL		
			Beta-pinene	BDL		
			Bromomethane *	BDL		
			Camphene	BDL		
			Chloroethane *	BDL		
			Chloroethene *	BDL		
			Cis-1,2-dichloroethylene	BDL		
			Cumene *	BDL		
			Formaldehyde *	BDL		
			Limonene	BDL		
		67-56-1	Methanol *	0.013	lb/MSF	E
			Methyl ethyl ketone *	BDL		
			Methyl isobutyl ketone *	BDL		
			Methylene chloride *	BDL		
			m,p-Xylene *	BDL		
			o-Xylene *	BDL		
			p-Cymene	BDL		
			p-Mentha-1,5-diene	BDL		
		108-95-2	Phenol *	0.015	lb/MSF	E
			Propionaldehyde *	BDL		
			Styrene *	BDL		
			Toluene *	BDL		
Veneer press, UF resin (SCC 3-07-006-55) (gluing veneer to particle-board substrate)	Uncontrolled	71-55-6	1,1,1-Trichloroethane *	0.00022[g]	lb/MSF 3/4	E
		80-56-8	Alpha-pinene	0.00054[g]	lb/MSF 3/4	E
		75-07-0	Acetaldehyde *	0.000099[g]	lb/MSF 3/4	E
		127-91-3	Beta-pinene	0.00011[g]	lb/MSF 3/4	E
		50-00-0	Formaldehyde *	0.0062[g]	lb/MSF 3/4	E
		66-25-1	Hexaldehyde	0.00017[g,h]	lb/MSF 3/4	E
		78-93-3	Methyl ethyl ketone *	0.00020[g]	lb/MSF 3/4	E
		123-72-8	n-Butylaldehyde	0.00014[g,h]	lb/MSF 3/4	E
		108-88-3	Toluene *	0.00047[g]	lb/MSF 3/4	E

[a] Emission factors represent uncontrolled emissions unless otherwise noted. SCC = Source Classification Code. * = hazardous air pollutant. ND = no data available. BDL = below test method detection limit; indicates that this pollutant has not been detected in any test runs on this source. Reference 19 unless otherwise noted.

[b] Emission control devices (baghouses) are considered no control for organic pollutants.

[c] CASRN = Chemical Abstracts Service Registry Number.

Table 10.6.2-7 (cont.).

[d] Emission factor units: Pounds of pollutant per oven-dried ton of wood material (lb/ODT). One lb/ODT = 0.5 kg/Mg (oven-dried). Pounds of pollutant per thousand square feet of panel (lb/MSF). One lb/MSF = 0.0049 kg/m^2. Pounds of pollutant per thousand square feet of 3/4-inch thick panel (lb/MSF 3/4). One lb/MSF 3/4 = 0.26 kg/m^3.

[e] THC as carbon = total hydrocarbon measurements using EPA Method 25A.

[f] VOC as propane = (1.22 × THC) + formaldehyde - (acetone + methane + methylene chloride); a value of zero is inserted in the equation for the specified compounds where no emission factor is available, or where the emission factor is reported only as "BDL".

[g] Reference 15.

[h] Based on M0011 data only; suspected to be biased low due to poor collection efficiency or analytical problems.

Table 10.6.2-8. WOOD SPECIES COMMONLY USED IN COMPOSITE WOOD PRODUCTS MANUFACTURING [a]

Wood product	AP-42 section	Hardwood species	Softwood species
Plywood	10.5	Oak, cherry, poplar, maple, larch	Firs, pines
Oriented strandboard	10.6-1	Aspen	Pines, firs, spruce
Particleboard	10.6-2	Aspen, oak	Pines, firs
Medium density fiberboard	10.6-3	Gum, alder, hickory	Pines, firs
Hardboard/fiberboard	10.6-4	Aspen, birch, beech, oak, maple	Pines
Engineered wood products	10.9	Aspen, birch, poplar	Pines, firs, hemlock

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