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Assessment of Fugitive Particulate Emission Factors for Industrial Processes

by

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TABLE OF CONTENTS

	<u>Page</u>
1.0 SUMMARY	1-1
1.1 Introduction	1-1
1.2 Priority Listing	1-1
1.3 Fugitive Particulate Emissions by Process Type	1-4
1.4 Ongoing Fugitive Emission Projects	1-9
2.0 SUPPORTING ANALYSIS FOR THE PRIORITY LISTING	2-1
2.1 Iron and Steel Production	2-1
2.1.1 Coke Manufacturing	2-1
2.1.2 Iron Production	2-10
2.1.3 Steel Production	2-16
2.2 Primary Nonferrous Smelting Industry	2-24
2.2.1 Primary Aluminum Production	2-24
2.2.2 Primary Copper Smelters	2-31
2.2.3 Primary Lead Smelters	2-38
2.2.4 Primary Zinc Production	2-45
2.3 Secondary Nonferrous Industries	2-52
2.3.1 Secondary Aluminum Smelters	2-52
2.3.2 Secondary Lead Smelting	2-58
2.3.3 Secondary Zinc Production	2-64
2.3.4 Secondary Brass/Bronze (Copper Alloy) Production	2-71
2.4 Foundries	2-77
2.4.1 Emissions	2-77
2.4.2 Adequacy of Emission Factor Data	2-77

TABLE OF CONTENTS (continued)

	<u>Page</u>
2.5 Minerals Extraction and Beneficiation	2-86
2.5.1 Emissions	2-86
2.5.2 Adequacy of Emission Factor Data	2-86
2.6 Grain Elevators	2-95
2.6.1 Emissions	2-95
2.6.2 Adequacy of Emission Factor Data	2-95
2.7 Portland Cement Manufacturing	2-102
2.7.1 Emissions	2-102
2.7.2 Adequacy of Emission Factor Data	2-102
2.8 Lime Manufacturing	2-110
2.8.1 Emissions	2-110
2.8.2 Adequacy of Emission Factor Data	2-110
2.9 Concrete Batching	2-116
2.9.1 Emissions	2-116
2.9.2 Adequacy of Emission Factor Data	2-116
2.10 Asphaltic Concrete Production	2-120
2.10.1 Emissions	2-120
2.10.2 Adequacy of Emission Factor Data	2-120
2.11 Lumber and Furniture Industry	2-125
2.11.1 Emissions	2-125
2.12.2 Adequacy of Emission Factor Data	2-125
APPENDIX A	A-1

TABLE 1-2. MAJOR SOURCES OF FUGITIVE PARTICULATE EMISSIONS

Industry and total uncontrolled fugitive particulate emissions, Mg/yr (tone/yr)	Major sources of fugitive particulate emissions	Uncontrolled fugitive particulate emissions		Percent of annual uncontrolled particulate emissions
		Mg/yr	(tons/yr)	
1. Foundries 106,719 (117,872)	Hot metal and slag transfer, casting, and refining Metal melting operations Core preparation	60,856 22,436 31,425	(76,152) (24,710) (112,584)	65 21 11
2. Portland cement 697,589 (769,961)	Loading, unloading and storage Crushing, grinding, and screening	518,937 127,421	1594,077 (142,078)	77 18
3. Minerals extraction and beneficiation 648,401 (714,096)	Crushing, grinding and screening Transfer and conveying Drilling and blasting Overburden removal	359,013 97,206 76,956 56,903	(395,387) (107,056) (84,752) (62,668)	55 15 12 9
4. Iron production 99,850 (110,070)	Sintering Hot metal and slag, transfer, casting, and refining	67,100 31,600	174,000 (35,200)	67 32
5. Secondary lead 4250 (4684)	Hot metal and slag, transfer, casting, and refining Reverberatory furnace	3,384 595	(3,730) (656)	79 14
6. Primary aluminum	Reduction cells Transfer and conveying Crushing, grinding, and screening	24,620 19,000 5,310	(27,140) (21,000) (5,850)	47 36 10

(continued)

TABLE 1-2. (continued)

Industry and total uncontrolled fugitive particulate emissions, Mg/yr (tons/yr)	Major sources of fugitive particulate emissions	Uncontrolled fugitive particulate emissions by source category, Mg/yr (tons/yr)		Percent of annual uncontrolled particulate emissions
		Mg/yr	(tons/yr)	
7. Asphaltic concrete 46,845 (51,638)	Transfer and conveying Loading, unloading and storage	28,740 14,370	(31,680) (15,840)	61 31
8. Limestone manufacturing 44,824 (49,410)	Crushing, grinding, and screening Transfer and conveying	36,388 7,653	(40,111) (8,436)	81 17
9. Coke manufacturing 131,700 (145,400)	Charging Quenching Pushing	63,800 18,200 25,500	(70,400) (42,200) (28,100)	48 29 19
10. Secondary aluminum 1809 (1,995)	Fluxing (chlorination) Chip (rotary) dryer	1,425 223	(1,575) (245)	79 12
11. Secondary brass/bronze 766 (842)	Metal melting Insulation burning Rotary dryer	358 275 69	(393) (303) (76)	47 36 9
12. Secondary zinc 429 (472)	Metal melting Crushing, grinding, and screening	290 138	(319) (152)	66 32
13. Lumber and furniture 8,665 (9,549)	Sawing Log debarking Wood waste storage and unloading	7,078 544 425	(7,802) (599) (468)	82 6 5

(continued)

(continued)

TABLE 1-2. (continued)

Industry and total uncontrolled fugitive particulate emissions, Mg/yr (tons/yr)	Major sources of fugitive particulate emissions	Uncontrolled fugitive particulate emissions by source category, Mg/yr (tons/yr)		Percent of annual uncontrolled particulate emissions
		Mg/yr	(tons/yr)	
14. Concrete batching 31,026 (34,200)	Loading, unloading, and storage	31,026	(34,200)	100
15. Primary copper 19,977 (22,024)	Metal melting	18,153	(20,675)	94
16. Grain elevators 1,238,127 (1,364,803)	Headhouse (legs)	602,360	(663,996)	49
	Transfer and conveying, loading, unloading, and storage	378,868	(417,631)	31
17. Primary zinc 1806 (1991)	Hot metal and slag transfer, casting, and refining	1,190	(1,321)	66
	Sintering	608	(670)	34
18. Primary lead 11,742 (12,945)	Biotering	6,978	(7,689)	59
	Metal melting	2,326	(2,566)	20
19. Steel manufacturing 61,520 (68,250)	Crushing, grinding, and screening	692	(763)	6
	Silver retort building	551	(608)	5
	Metal melting	51,600	(57,300)	84
	Hot metal end slag transfer, casting, and refining	9,600	(10,600)	15

2.11 LUMBER AND FURNITURE INDUSTRY

2.11.1 Emissions

Specific fugitive particulate emission sources at the sawmill are debarking, sawing, and sawdust handling operations. Log handling and bucking (log length shortening) are normally negligible sources of fugitive emissions. Emissions from furniture manufacturing occur principally from wood waste handling and storage. Figure 2-19 depicts the general process flow for the lumber and furniture industry, and Table 2-46 lists the emission sources noted in the process flow diagram. Table 2-47 indicates that potential uncontrolled emissions from these sources are 8,665 Mg (9,549 tons). This table also presents process source fugitive emission factors, 1976 domestic consumption of logs for lumber and lumber for furniture, and estimated total uncontrolled fugitive particulate emissions. The largest single source appears to be the sawing of logs for lumber, which accounts for nearly 80 percent of the total.

2.11.2 Adequacy of Emission Factor Data

Processing of logs for lumber and subsequent further processing for furniture manufacture begins at the sawmill. Principal operations to be considered as sources of fugitive emissions are log debarking; sawing; and sawdust pile loading, unloading, and storage. The respective emission factors are estimated to be 0.012 kg/Mg (0.024 lb/ton) of logs debarked, 0.175 kg/Mg (0.35 lb/ton) of logs sawed, and 0.5 kg/Mg (1.0 lb/ton) of sawdust handled.² Furniture manufacture fugitive emissions are assessed as emanating principally from the wood waste storage bin via venting and loadout. Fugitive particulate emission factors have been estimated at 0.5 kg/Mg (1.0 lb/ton) of wood waste stored and 1.0 kg/Mg (2.0 lb/ton) of wood waste loaded out.² All values noted are based either on material balance of waste produced

Table 2-46. IDENTIFICATION OF EMISSION SOURCES SHOWN ON THE LUMBER AND FURNITURE PRODUCTION PROCESS FLOW DIAGRAM^a

Fugitive emission sources	
1. Debarking 3. Sawdust pile 5. Wood waste storage bin loadout	2. Sawing 4. Wood waste storage bin vent
Point sources	
A. Sawing (cyclone exhaust) C. Sander (cyclone exhaust)	B. Planing and trimming (cyclone exhaust)

^a Numeral and letter denotations refer to emission sources on the previous figure.

Table 2-47. ESTIMATED UNCONTROLLED FUGITIVE PARTICULATE EMISSIONS FROM THE LUMBER AND FURNITURE INDUSTRY

Emission source	Uncontrolled fugitive particulate emission factor ^a		1976 U.S. consumption of logs for lumber ^b		1976 U.S. lumber consumption for furniture ^b		Estimated uncontrolled emissions	
	kg/Mg	lb/ton	1000 Mg	1000 tons	1000 Mg	1000 tons	Mg/yr	tons/yr
<u>Brewell</u>								
Log debarking	0.012	0.024	45,299 ^c	47,913 ^f	-	-	544	599
Sawing	0.175	0.350	40,044	44,592	-	-	7,078	7,802
Sawdust pile loading, unloading and storage	0.5 ^d	1.0 ^d	809 ^d	892 ^e	-	-	405	446
<u>Furniture manufacturing</u>								
Wood waste storage bin vent	0.5	1.0	-	-	425 ^f	460 ^f	213	234
Wood waste storage bin in/out	1.0	2.0	-	-	425 ^f	460 ^f	425	469
Total							9,665	9,519

^a Reference 2. Brewell emission factors are expressed as units per unit weight of logs processed. Furniture manufacture emission factors are expressed as units per unit weight of wood waste handled.

^b Reference 1. Estimations.

^c Considers an additional (assumed) weight of 12 percent for bark.

^d Factors are expressed as units per unit weight of sawdust handled.

^e Assuming sawdust to constitute 9 percent in which 25 percent of that generated in stockpiles.

^f Assuming wood waste to approximate 30 percent of the total 1,415,200 Mg (1,560,000 tons) of lumber consumed in furniture manufacture.

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None
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followed by judgment as to the airborne particulates or on observations made of specific plant operations during industry visits. None are based on actual test information and therefore do not qualify as having sufficient support for incorporation into AP-42.

REFERENCES FOR SECTION 2.11

1. Personal communication made between Dr. Muench, National Forest Products Association and J. Thomas Bertke, PEDCo Environmental, Inc. October 1977.
2. Technical Guidance for Control of Industrial Process Fugitive Particulate Emissions. PEDCo Environmental, Inc. U.S. Environmental Protection Agency. Contract No. 68-02-1375 Task No 33. March 1977.

APPENDIX A
SUMMARY OF FUGITIVE PARTICULATE EMISSION FACTORS
FOR POSSIBLE INCLUSION INTO AP-42

10.4 WOODWORKING OPERATIONS

Since most woodworking operations control emissions out of necessity, fugitive emissions are seldom a problem. However, the wood waste storage bins are a common source of fugitive emissions. Table 10.4-2 shows these emission sources and their corresponding emission factors.

Information concerning size characteristics is very limited. Data collected in a western red cedar furniture factory equipped with exhaust ventilation on most wood working equipment showed most suspended particulates in the working environment to be less than 2 μm in diameter.⁷

Table 10.4-2. POTENTIAL UNCONTROLLED FUGITIVE PARTICULATE EMISSION FACTOR FROM WOODWORKING OPERATIONS

EMISSION FACTOR RATING: E

Type of operation	Particulates ^a	
	lb/ton	kg/MT
Wood waste storage bin vent	1.0 ^b	0.5
Wood waste storage bin loadout	2.0 ^b	1.0

^a Factors expressed as units per unit weight of wood waste handled.

^b Engineering judgement based on observations on plant visits.

ADDIT

7.

ADDITIONAL REFERENCES FOR SECTION 10.4

7. Industrial Environmental Health, The Worker and the Community. Academic Press. New York and London. 1972.